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[FOR THE 41ST REPORT OF THE NEW YORK STATE MUSEUM OF NATURAL HISTORY.]

FOURTH REPORT

OF THE

Injurious and Other Insects

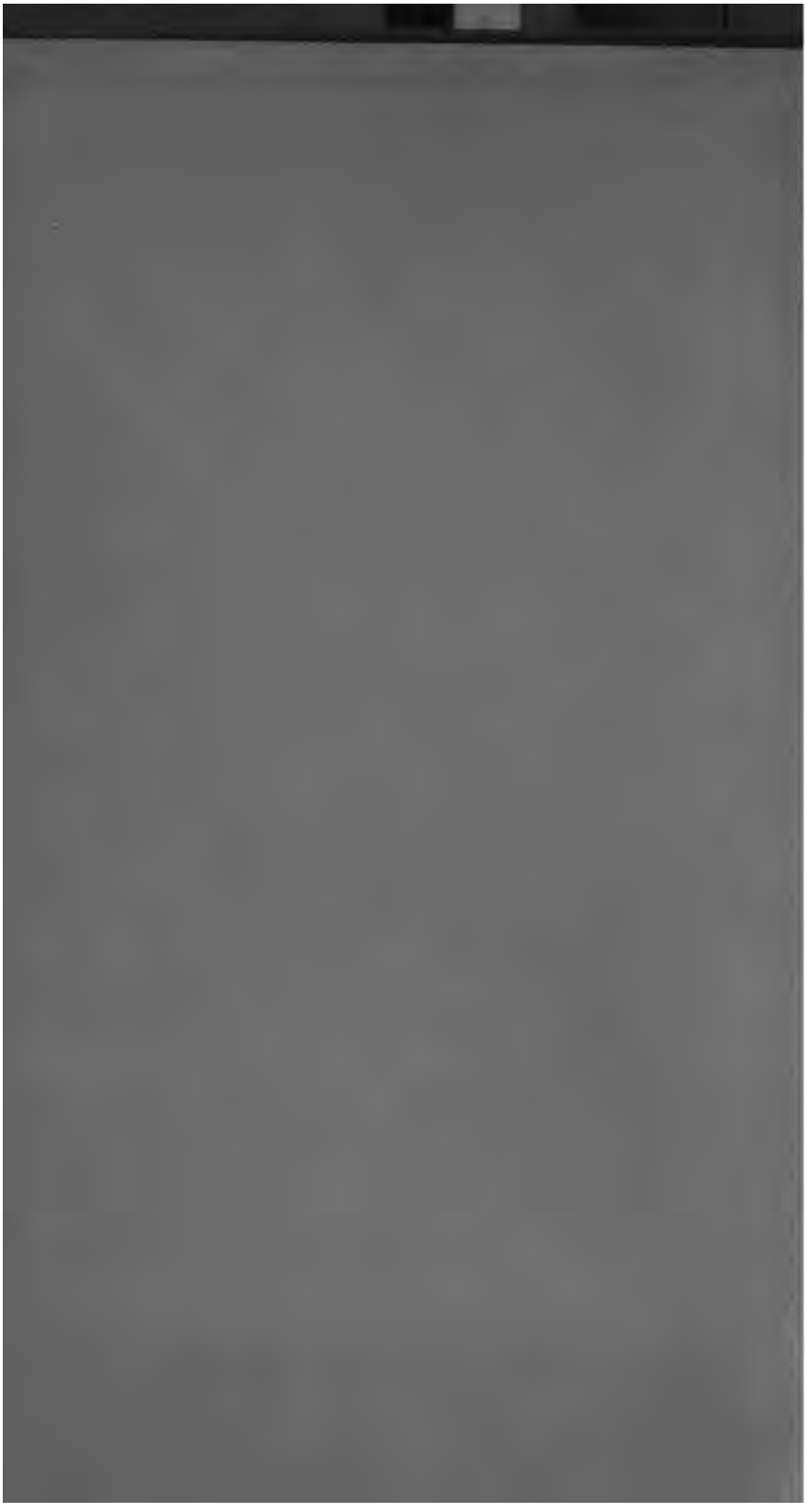
OF THE

STATE OF NEW YORK.

Made to the Regents of the University, Pursuant to Chapter 355, of the Laws of 1883.

BY J. A. LINTNER, PH. D., STATE ENTOMOLOGIST.

ALBANY:
JAMES B. LYON, PRINTER.
1888.



REPORT

OF THE

STATE ENTOMOLOGIST

OF NEW YORK.

[From the 41st Report of the New York State Museum of Natural History.]

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NOTE.

By provisions in an act of the Legislature, S. N. Y. — Chapter 355 of the Laws of 1883 — entitled an act to regulate the State Museum of Natural History * * * "the State Entomologist is placed on the scientific staff of the Museum, and the Trustees of said Museum are authorized to publish each year his scientific contributions, which publication shall be in lieu of the report now required by law from the State Entomologist."

In compliance with the above provisions, four reports have subsequently been made to the Regents of the University of the State of New York, and have been published in the Annual Reports on the State Museum.

As the desired facilities for publication were not afforded under the then existing system of public printing, the reports have been brief and without the illustration and other features that were thought to enhance the usefulness and value of those preceding.

The report for 1883 will be found in pages 45–60 of the Thirty-seventh Report on the New York State Museum of Natural History. It contains notices of official work and field collections, and of depredations by Orgyia in Albany and by the Chinch bug in Northern New York.

The report for 1884, is contained in the Thirty-eighth Museum Report, pages 67–76. In addition to a list of the publications of the State Entomologist for the year and contributions to the Department for the same time, a sequel to the insect attacks of the preceding year is appended.

The report for 1885, occupies pages 77–125 of the Thirty-ninth Museum Report. For an enumeration of its contents see page 200 of this volume.

The report for 1886, is contained in pages 79–154 of the Fortieth State Museum Report, published in 1887. For its contents see page 204 of this volume. Of this report, 200 copies, with title-page and cover were printed as separates for the Entomologist for his distribution. Although not so designated, it may be regarded as the "Third Report on the Insects of New York," etc., in continuation of the series (the present being entitled the Fourth), and for permitting a readier reference to it in citations. It has already been so referred to in scientific publications.

Of the reports for 1883, 1884 and 1885, no copies having been printed outside of the small museum edition, such portions of them as may be deemed of interest, will probably be incorporated in the next (Fifth) report of the State Entomologist.

REPORT.

OFFICE OF THE STATE ENTOMOLOGIST,
ALBANY, *December* 14, 1887.

To the Honorable Board of Regents of the University of the State of New York:

GENTLEMEN.—In accordance with the law of 1883, regulating the State Museum of Natural History, I herewith beg leave to present to your Honorable Board the following report of some of my labors and investigations during the past year. In connection therewith, I will refer incidentally to some entomological studies which are being prosecuted by others.

As in preceding years, my studies have been almost entirely in the direction of the economic relations of insects. So important are these relations to the farmer, the gardener, the fruit-grower, the florist, the manufacturer, the exchanger of produce or manufactures, and, in consideration of our numerous household pests — to every member of community, that no apology is needed if they are permitted, for the time, to claim almost the exclusive attention of your entomologist. It was to meet this need of reliable information of our insect pests, and of the most efficient means of controlling their ravages, that this Department was established in 1880, and has since been sustained by the State. Yet, pure science must ever form the basis of the applications of science. The proud position that economic entomology has attained, is but the result of the earnest, patient, and long-continued scientific study that has preceded it, and without which it would have been an impossibility. To particularize: a very large proportion of the insects of the United States have been described, named and classified — our catalogues embracing about twenty-five thousand species. The several orders and suborders have been taken up by special students who have devoted their best energies and the greater part of their lives to descriptive and classificatory study. Thus: Dr. LeConte, whose name is inseparably connected with American Coleopterology —

during the forty years that he devoted to the work, had described nearly the one-half of our known species of Coleoptera, viz., 4,739, and given original definitions of more than 1,100 of the higher groups.* Since his death in 1883, the order which he had so greatly advanced, has continued to receive the untiring study of Dr. Horn, and is being rapidly progressed through frequent monographic and other publications of superior excellence.

To Mr. E. T. Cresson we owe much of our present knowledge of the Hymenoptera, through lists and monographs of several of the principal families, and last, through a Synopsis of the Hymenoptera of North America just published, giving the leading characters of families and genera, with synoptic tables which will afford the means for their ready recognition. One of the families of this order — perhaps the most difficult, from its many species and microscopic size of most of the number — the *Chalcididæ*, is being successfully studied by Mr. L. O. Howard, of the Entomological Division of the U. S. Agricultural Department at Washington.

Dr. S. W. Williston, of New Haven, is presenting from time to time, monographs of families in Diptera — an order which has been greatly neglected among us since the retirement of Baron Osten Sacken from the Russian Legation at Washington, and his removal to Germany. Fortunately for us, Baron Osten Sacken's interest in American Diptera, is still maintained, as may be seen in his occasional publications, and in a contribution from him in this report and other services acknowledged.

The Hemiptera still claim the devoted attention of Mr. P. R. Uhler, of Baltimore, who has recently given us our first list of the order, comprising the suborder of Heteroptera, to be followed soon, it is promised, by that of the Homoptera. Mr. E. P. Van Duzee, of the Grosvenor Library at Buffalo, is also working earnestly and successfully upon these insects — by far too generally regarded as unattractive.

Mr. S. H. Scudder's studies of the Orthoptera are being suspended, for a brief time only it is hoped, during the preparation and printing of his long-promised and anxiously awaited "Butterflies of New England."

Dr. H. A. Hagen, of the Museum of Comparative Zoölogy at Cambridge, Mass., still continues to be the highest authority in the Neuroptera, and a most diligent collector and custodian of all that

*Scudder, in *Trans. Amer. Ent. Soc.*, iv, 1884, p. xviii.

relates to the literature and biological illustration of North American insects.

In Lepidoptera, Mr. William H. Edwards is continuing his invaluable publications and illustrations in the Butterflies of North America; while the Heterocera (moths) are receiving their share of attention at the hands of Mr. Henry Edwards, Professor Fernald, Rev. Mr. Hulst, Mr. J. B. Smith, and others.

To such special students as are above named, the economic entomologist, whose field of study necessarily embraces all the orders without particular devotion to any one, has often occasion to apply for aid in the determination of new forms, discrimination between those that are closely allied, geographical distribution, extrication of perplexing synonymy, etc., etc. Much that he lacks may, by this means, be readily supplemented. In all cases such desired aid is cordially extended. I take great pleasure in acknowledging my personal obligations to each of the above named gentlemen — specialists, for the assistance that has always been promptly and cheerfully—ofttimes unsparingly, extended to me.

An unusual number of interesting insect attacks have been brought to my notice during the present year. Owing to the brief time that could be given to the preparation of this report but a few of them can be noticed, and those not to the extent that seems desirable.

The cereals of the State have not been visited to any unusual degree, with insect injuries, with the single exception of a demonstration of the joint-worm fly, *Isosoma hordei* (Harris), in some wheat fields of Niagara county. As there is apprehension that its presence in the western fields may be continued for a series of years, as is its wont when a footing has been secured, a somewhat extended notice of it has been given in the following pages, in which means are suggested, which, if diligently employed, should arrest its spread.

I have not heard of a continuation of the Hessian fly injuries, which for a few preceding years had been the cause of heavy losses to the wheat crop of Western New York, as notably in Wayne and Ontario counties in 1885, when the aggregate loss was estimated at $100,000, and in Seneca county, where, in the town of Junius, it was claimed that 40,000 bushels of wheat had been destroyed.

Less damage has been reported by the clover-seed midge, *Cecidomyia leguminicola* Lintn., from Central New York. Perhaps, as its distribution extends into adjoining States and into Canada, its operations will be less severe where they were first observed. It has become very destructive in Canada, especially in Central and South-western Ontario, where its injuries are only being met by cutting but one crop of clover during the season. Mr. Fletcher, entomologist of the Dominion of Canada, has stated in a recent report: "The only instances where any seed has been reaped are where, instead of allowing the clover to stand in the field till the end of June, it has been fed off by cattle and sheep till the beginning or middle of June, and then left to go to seed for the autumn crop. * * * The verdict of all the growers who have tried the experiment now seems to be that two crops can not be secured, and to get any seed at all, the first crop must be pastured until the beginning, and not later than the middle, of June. In this way the minute larvæ of the flies, which are to lay the eggs for the second brood, are eaten by the cattle at the same time as the clover and destroyed."

In my report for 1886, reference was made to the nearly entire destruction of the hop crop of the State, by the hop-vine aphis, *Phorodon humuli* (Schrank), only about one-twelfth of an average crop having been secured. As predicted — in part from the remarkable abundance throughout the latter part of the season of its insatiable destroyers, the lady-birds, and particularly of one species, *Adalia bipunctata* (Linn.), the two-spotted lady-bird — the hop-yards, the present year, have been favored with an almost entire exemption from aphis attack. Those who are interested in hop culture — so important an interest in our State — may be especially congratulated in that the mystery that has so long enveloped a large portion of the life-period of the hop-vine aphis, viz., from its disappearance from the yards in the autumn to its reappearance therein the following spring, has, during the present year, been satisfactorily solved. For this gratifying achievement we are indebted to the United States Department of Agriculture, through the patient and laborious investigations conducted, almost unintermittingly from May to November, by Professor Riley and his assistants, of the Entomological Division. I extract from a note appended to proof-sheets of my report for 1886 (not yet published),

the following summary of the life-history of the insect, as it has been worked out within the last few months:

"The eggs are deposited on the twigs of plum trees in the autumn (October). They hatch at the putting out of the leaves the following spring. Three generations follow on the plum, of which the last only is winged, which at once migrates to the hop-yards. The fourth and the succeeding generations on the hop, to the eleventh inclusive, are wingless females. The twelfth generation consists of winged males and females — the latter, agamic, and these return to plum trees in September. Here the thirteenth generation is composed of sexual wingless females, which, after mating, deposit the eggs which are to hatch the following spring, in continuation of the species. For a detailed statement of the above, see a communication made by Mr. L. O. Howard, of the Division of Entomology, under instructions from Professor Riley, in the *Country Gentleman*, for November 17, 1887, page 875, giving also the latest studies of Professor Riley upon the insect, made in England during the present autumn."

Now that the winter abode of the hop-aphis has been ascertained to be on plum trees, in the egg state, thereby, to a certain extent, bringing it within our reach (some entomologists are not yet willing to concede that it does not, in part, hibernate in the soil of hop-yards), it may with propriety be claimed that "the practical outcome of the investigation is very great." But it is to be feared that our worthy Commissioner of Agriculture, who has lent the aid of his department to this investigation, has been over sanguine in his announcement in his report of the present year, that "there is now no reason why this pest, which last year damaged the crops to the extent of hundreds of thousands of dollars, should be longer feared by hop-growers."

The onion crop has suffered severely from insect attack in various portions of the State. Serious complaints have been made of injuries from the onion maggot (the larva of the onion fly, *Phorbia ceparum* Meigen), in Suffolk, Queens, Rensselaer, Essex and Genesee counties. In Otsego county, wire-worms are reported as having done much harm, while in Queens county, cut-worm attack was combined with that of the onion-fly. These injuries were not general, for in Saratoga and Livingston counties the crop is represented as having been remarkably free from the ordinary depredations of its insect enemies.

Young corn, in Bethany, Genesee county, was attacked in June, by caterpillars, living within webs and silken tubes in the ground among the roots, which they leave to feed upon the stalk beneath the ground and to some extent, on the leaves above, after the habit of the cut-worms, although belonging to a different family from the *Noctuidæ*, viz., the *Pyralidæ*. In some cases, the injury caused by them had necessitated replanting. From examples sent to me by Mr. W. E. Harding, I was able to rear the moth, and to find it to be a species of *Crambus*, distinct from *C. zeëllus* Fern., which has been so injurious to corn in Illinois, although the larval operations as described to me are almost identical with those of that species. A description of the caterpillar was made, which will be given, together with a fuller notice of the insect and its operations, after the moth, at present in the hands of Professor Fernald for determination, shall have been named. *Crambus zeëllus*, known in Illinois as the root web-worm, in an instance related, was found to have cut down every hill of corn in a field of twenty acres.

Injury to corn is reported by Mr. C. L. Landers, of Afton, Chenango county, from the larvæ of one of the larger Chrysomelid beetles, which, upon rearing the imago, proves to be *Chelymorpha Argus* Licht. He also observed the same, feeding on barley, cabbage, grass, plantain and other weeds. The occurrence of this insect in harmful number upon a valuable field crop is so unusual that it was noticed in a communication to the *Country Gentleman* of September 1, 1887, as a "Milkweed Beetle with Bad Habits;" see page —, of this Report. Beetles from the pupæ sent to me, emerged August nineteenth.

Under date of May ninth, Mr. J. W. Babcock, of Rochester, observed an attack upon his apple trees, the nature of which was quite new to him. Both the buds and blossoms were being spun together and rapidly eaten. From examples received, and from moths subsequently reared, it was ascertained that the insect was the eye-spotted bud-moth, or *Tmetocera ocellana* (Schiff.). The perfect insect was obtained on June third, although July is given as the usual time of its appearance. Mr. Babcock was informed that the attack could be arrested by spraying the trees with London purple in water — one-fourth pound to a barrel.

The rose-beetle, *Macrodactylus subspinosus* (Fabr.), made an appearance in unwonted numbers in Granby, Oswego county, in the fore part of June. The *Oswego Times* of June tenth, stated

that they were in such force as to devour all the foliage of the apple trees and eat the young fruit. Examples of the insect were sent to me for name, with inquiries of their nature and of means for arresting their ravages, as they were exciting much alarm among the fruit-growers of that region. A reply was made in which were given the best known remedies against the pest, which was published in the *Oswego Times* of June eighteenth (see summary of the communication in another page of this Report). At Memphis, Onondaga county, at the same time, the beetles were said to be eating the young peaches and killing the corn.

An attack on apple trees at Moriches, Suffolk county, in early June, by the fall canker-worm *Anisopteryx pometaria* Harris, was recognized, in examples of the caterpillars sent.

A formidable attack was made by the quince curculio, *Conotrachelus cratægi* Walsh, late in September, in the quince orchards of T. C. Maxwell & Bros., at Geneva, N. Y. The injury had been serious the preceding year, but this season it was still more severe. Of the crop of 1,000 bushels, fully one-third was more or less affected. Some of the quinces that appeared the finest outwardly, were found upon cutting, to contain several of the larvæ feeding in cavities within, defiled with their blackened excrementa. It was learned on inquiry, that probably about one-twentieth of the fruit dropped from the trees, the larvæ continuing therein until driven out by decay. The entire crop ripened earlier than usual, and much of it decayed while still upon the trees. Recommendation was made of working the ground of the orchard thoroughly so as to destroy the larvæ by crushing and exposure after they had buried for pupation.

The novel form of injury inflicted upon the elms of Albany in the year 1883, by the white-marked tussock moth, *Orgyia leucostigma* (Sm.-Abb.), in girdling the young tips of elms and causing them to fall, has been repeated this year, as will be found noticed hereafter.

The imported elm-leaf beetle, *Galeruca xanthomelæna* (Schrank), which for several years past, to the southward of us, has been such a merciless defoliator of the elms, completely robbing them of their value as shade and ornamental trees and reducing them to unsightly harborers and propagators of a disgusting insect presence, has continued steadily to progress over the south-eastern portion of the State, until it has reached Pough-

keepsie — midway between Albany and New York — in its northern extension. It is devoutly to be hoped that through the discoveries and improvements made within the last few years in insecticides and in means by which they may be conveyed into and distributed over our larger shade trees, the distribution of this obnoxious foreign intruder may speedily be arrested.

Another of our numerous imported pests, the larch saw-fly, *Nematus Erichsonii* Hartig, has for some time been extending slowly over Northern New York, and this year has been observed in some of the south-eastern counties of the State, as in Albany, Schoharie and Otsego. In some localities where it has been the most abundant, it has caused the death of large numbers of the native larchs or tamaracks, *Larix Americana*. I had hoped to present in this report an account of observations made by me upon this insect the past summer, in Hamilton county and elsewhere, but it is necessarily postponed for the present.

A strawberry leaf-folder, of somewhat different habits from those ascribed to the leaf-folder known to infest this plant, was observed by Prof. Peck, at Menands, Albany county, the latter part of June. It was believed to be identical with one that had appeared in September and October of the preceding year, thus indicating a double brood. The attempt to rear the moth was unsuccessful.

The Zebra cabbage worm, as from its peculiar markings it has been named — scientifically, *Mamestra picta* (Harris), which has won for itself a bad reputation from its readiness to feed upon a large number of quite dissimilar food-plants, as several of the garden vegetables, flowering plants, ornamental shrubs, buckwheat, etc., has been discovered at Chatham, Columbia county, by Mr. George T. Powell in defoliating currant bushes. They were found in their young stage feeding socially in large companies, and from having been rarely seen at that age they were not recognized until subsequent moltings developed their well-known and characteristic ornamentation.

In occasional instances where insect injuries are presented for which no explanation can be offered, it is thought proper to report them in the hope that they may have been observed and accounted for by some other entomologist or careful observer. Attention was called in August to such an attack, by Mr W. E. Harding, of

Bethany, N. Y. Larvæ had been seen by him eating into the ripe kernels of wheat in the head, but he neglected at the time to save any of them for examination. Later when they were looked for, none could be found. The aggregate injury could not have been very great, for it was stated that "sometimes a head was found with several injured kernels." From the irregular manner in which the eating had been done, it could not have been the work of the Angoumois moth, *Sitotroga cerealella* (Oliv.). Mr. Harding thought from the appearance of the depredator as he observed it, that it belonged to the Lepidoptera. Examples of the injured grain have been preserved in the State collection.

A similar form of attack on plums was submitted by Mr. J. J. Thomas, of Union Springs, N. Y., which could not be identified. Three Lombard plums, nearly ripe, were sent, which had been excavated in each case within one-eighth of an inch of the stem, to the depth of about one-tenth of an inch, and of about the same diameter. The original punctures probably had not been so large, but the skin surrounding it may have shrunken and parted in its drying. The excavations had more or less gum in them. One of the plums showed a smaller puncture a little removed from the larger, but in none could any oviposition or trace of larval operation be discovered. The pits and their contents were in their natural state, with no evidence of having been reached by the larva of the plum-gouger, *Coccotorus scutellaris* Lec.—a curculionid beetle of general distribution throughout the Mississippi valley whose habit is to penetrate the stone while still tender and feed upon the kernel. The plums were from Mr. H. C. Allen, of Erie county, who states that at least one-half of his crop had been destroyed in this manner — the cavities developing into rot. He had not been able to discover any insect making the puncture.

Another unexplained attack, presenting itself for the first time the present year, is a girdling of the tips of currant bushes, by some unknown insect, observed in Albany and vicinity during the months of May and June. The observations made and some speculations thereon are given in this Report.

Some other insect attacks brought to notice the past season may be found among the "Brief Notes on Various Insects," with which this Report concludes.

During the year I have availed myself of opportunities offered, in an endeavor to extend a knowledge of insect life and insect habits in their economic aspects, in addresses made before the following societies and organizations:

Western New York Horticultural Society at Rochester.
New York Farmers' Club, New York city.
Farmers' Institute, at Batavia.
Farmers' Institute at Schenectady.
Agassiz Association, Albany Chapter.
Dana Natural History Society at Albany.
Albany Institute.
Troy Scientific Association.
Torrey Botanical Club, New York city.
Entomological Club of Amer. Assoc. Adv. Sci.
American Pomological Society at Boston.

In conclusion, I beg leave to present herewith the following: Notices of insect attacks and miscellaneous observations; a list of the contributions made to the Department during the year; and a list of the publications of the Entomologist, for the same period, which, while given mainly as a record of entomological literature, may also serve to show some of the additional work of the Department other than that presented elsewhere in the Report.

Respectfully submitted.

J. A. LINTNER.

INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS.

THE INSECTS OF THE HEMLOCK.

[NOTE.—The following list of insects feeding on the hemlock, together with a reference to amount and character of injury inflicted, was drawn up at the request of Professor A. N. Prentiss, of Cornell University, for use in the monograph on the hemlock, *Tsuga Canadensis*, which he had been engaged to prepare for the Division of Forestry, in the U. S. Department of Agriculture. It is understood that his manuscript was some time since presented to the Department, but in the absence of the needed facilities for prompt publication of the labors of the Division, there is no prospect of its early issue. Under the circumstances, in compliance with the request made, Professor Prentiss has kindly given me permission for the present use of the notes communicated to him. A few additions have been made to the paper since its return, and some figures introduced.]

While the statement of Dr. Fitch, that "the hemlock is much the most free from insects of any tree in our country," may not be strictly true, yet its comparative freedom from insect attack is a fact, and one for which no satisfactory reason may be assigned. The peculiar pungent odor of turpentine is generally thought to be repulsive to insects, and the spirits of turpentine is not infrequently employed to protect clothing, woolens, and specimens of natural history from the attack of moths, and some of the smaller coleoptera. To some insects it is undoubtedly poisonous, and even its odor is fatal to them. And yet, there are Lepidopterous larvæ, as for example, *Pinipestis Zimmermani* Grote (*Bull. U. S. G.-G. Surv. Terr.*, iv, 1878, p. 700), and *Harmonia pini* Kellicott (*Entomologica Americana*, i, 1885, pp. 171–173) which live just within the sap-wood of young and vigorous pines; their bodies are constantly coated with the pitch, it constitutes part of their food, as it is found mingled with their excrement, and their pupal stage of transformation is undergone within a mass of pitch-exudation upon the bark of the tree. The pines furnish the requisite food for a large number of insects, most of which are limited to them, although a few extend their range to other *Coniferæ*, and to some of the deciduous trees. M. Edouard Perris has given a list of more than a hundred species which infest the maritime pine of Southern Europe. Dr. Fitch in his *Fourth Report on the Insects of New York*, in 1858, notices sixty-six pine-feeding insects. Dr. Packard in his *Insects Injurious to Forest*

and Shade Trees, in 1881, has extended the number to 106, occurring on the different species of pines in the United States, while omitting several Hemiptera (bugs) which occur in greater numbers upon other kinds of vegetation. It will be safe to say that we know of, at least, 125 species of pine-inhabiting insects.

About thirty species are recorded as infesting spruces (*Abies nigra* and *A. alba*), and about the same number the firs (*Abies balsamea*, mainly). Dr. Packard (*loc. cit.*) names fifteen species on the Junipers (*Juniperus Virginianus* and *J. communis*), and but three on arbor vitæ (*Thuja occidentalis*).

The species known to feed upon the Hemlock are the following:

LEPIDOPTERA.

Eacles imperialis (*Drury*); Fitch, 4th Rept. Ins. N. Y., p. 62.

Thyridopteryx ephemeræformis (*Haworth*); Glover, Ent. Ind. Agr. Repts., p. 90.

Tolype laricis (*Fitch*); Lintner, 1st Rept. Ins. N. Y., p. 85.

Cleora pulchraria *Minot;* Packard, Rept. Comm Agr. for 1885, p. 327.

Tephrosia Canadaria *Guen.;* Hulst, Ent. Amer., iii., p. 49.

Eupithecia luteata *Packard;* Packard, Bull. 3, Div. Entomol., p. 24.

"The Hemlock inch-worm;" Packard, Ins. Inj. For.-Sh. Trees, p. 242.

"The ten-lined pine inch-worm;" Packard, ib., ib.

Tortrix fumiferana *Clem.;* Pack., Rept. Comm. Agr. for 1883, p. 146.

Gelechia abietisella *Pack.;* Id., ib., p. 150.

A leaf-miner, undetermined; received from Prof. Prentiss.

COLEOPTERA.

? Dicerca sp.; Packard, Ins. Inj. For.-Sh. Trees., p. 241.

Hadrobregmus foveatus (*Kirby*); Packard, loc. cit. sup.

Orthosoma brunneum (*Forster*); Packard, loc. cit. sup.

Hylotrupes bajulus (*Linn.*); Fitch, 4th Rept. Ins. N. Y., p. 62.

Callidium sp.; Thomas, 6th Rept. Ins. Ill., p. 149.

Leptura Canadensis (*Fabr.*); Packard, loc. cit., p. 240.

"A large longicorn borer," indet.; Packard, loc. cit., p. 241.

"A short longicorn borer," indet.; Packard, loc. cit., p. 241.

Nyctobates Pennsylvanicus (*De Geer*); Schaupp, Bull. Brook. Ent. Soc., iv., p. 23.

Pissodes strobi *Peck;* Packard, loc. cit, p. 231.

Crypturgus atomus (*LeConte*); Packard, loc. cit., p. 231.

HEMIPTERA.

Cicada septendecim *Linn.;* Riley, 1st Rept. Ins. Mo., p. 24.

Lioderma ligata (*Stal*); Fitch, 4th Rept. Ins. N. Y., p. 62.

ORTHOPTERA.

Caloptenus spretus *Uhler;* Riley, 1st Rept. U. S. Ent. Comm., p. 253.

The injuries from the above insects (twenty-five species) differ in character and in degree, as will appear from the following brief notices of their depredations:

Eacles imperialis, or the pine Emperor moth, is among the largest of the family of *Bombycidæ*, which contains our largest lepidopterous insects. Its caterpillar, from its great size, is necessarily quite voracious as it approaches maturity, and will readily denude a limb of its leaves; but fortunately it never occurs in numbers sufficient to enable it to inflict any serious injury. It is seldom that more than two or three occupy the same tree. A figure of the moth — not a good one, but serving the purpose of recognition — is given in the *Natural History of the State of New York — Agriculture*, by E. Emmons, vol. v., pl. 40, fig. 7.

Tolype laricis, the larch-lappet, infests also the larch (*Larix Americana*), from which it has drawn its specific name. It also occurs upon pines, and is but seldom met with on the hemlock. It is a beautiful, interesting and rare species — never becoming so numerous as to prove a pest. A detailed account of its transformations, life-history, distribution, etc., is contained in the first Report on the Insects of New York. The male is shown at figure 1, and the female at figure 2.

Fig. 1.—The male TOLYPE LARICIS.

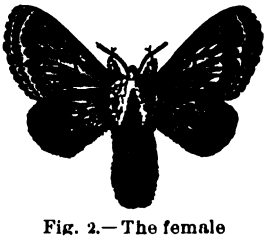

Fig. 2.—The female TOLYPE LARICIS.

Thyridopteryx ephemeræformis, the basket or bag-worm, is also seldom met with on the hemlock. Of its twenty known food-plants, its favorites are, apparently, the red cedar (*Juniperus Virginianus*), and the arbor vitæ (*Thuja Occidentalis*).

Cleora pulchraria is one of the "measuring worms" (as are the three following species), which is found frequently on the hemlock, but it is of an inconsiderable size, and never multiplies to an injurious extent.

Tephrosia Canadaria is another measuring worm, which feeds on tamarack and spruce, and probably on pine, as the moth has been found abundantly at Center, N. Y., amidst the pines of that locality.

Eupithecia luteata is common on several of the evergreens. It is a small larva, and of no special economic importance.

The hemlock inch-worm (a *Eupithecia* species) and the ten-lined inch-worm, as in the absence of a knowledge of the moths which they produce, the two are designated by Dr. Packard, have only been observed *in Maine, and nothing* has been recorded of their habits.

Tortrix fumiferana, or the spruce-bud worm, has been very destructive to spruces in portions of Maine, as observed and reported by Dr. Packard. It has occurred in very large numbers in some localities, where it has caused the death of a large number of trees, by eating off the buds in June as they were developing, and arresting the new growth. In a few instances only, it has been detected feeding on hemlock. It is found, also, in Massachusetts, New York, Pennsylvania, Ohio, Illinois and Wisconsin.

Gelechia abietisella is a small insect belonging to the *Tineidæ*. It is known, up to the present, only on the hemlock, in which the caterpillar causes dead patches on the smaller twigs by biting off and weaving together several of the leaves into a broad, flat, irregular case, within which it lives in a rude silken tube.

The Coleopterous larvæ infesting the hemlock, are of greater economic importance, as they are all borers in the trunk, limbs and twigs, or excavate smaller burrows between the wood and bark.

The *Dicerca* sp? was found under the bark of a dead tree. Most of the species of this genus burrow in the sap-wood a little beneath the bark, and usually attack trees only of an impaired vitality.

Hadrobregmus foveatus has been found not very abundantly, not only in logs and in stripped and piled bark, but also within the bark of large healthy trees (Packard). It belongs to the destructive family of *Ptinidæ*, which contains a large number of species, mostly of small size, and of injurious habits, although more generally living in vegetable matter in an incipient stage of decay.

Orthosoma brunneum is a common and well-known longicorn beetle, of a large size, the larva of which sometimes measures two inches in length. It is a member of the extensive family of *Cerambycidæ*, consisting of an immense number of species — some of remarkable size and great beauty. Their larvæ subsist exclusively on the woody parts of plants, within the trunks, branches and roots of trees. *O. brunneum* is generally distributed over the Atlantic States, but fortunately its attack is usually confined to dead or dying trees, unlike a closely allied species formerly embraced in the same genus with it, viz., *Prionus laticollis*, which, at times and in certain localities, is very destructive to grape vines and apple and pear trees, which it kills by burrowing into their roots.

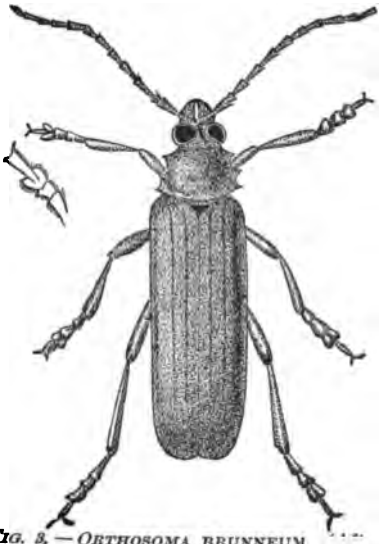

FIG. 3. — ORTHOSOMA BRUNNEUM (Emmons.)

O. brunneum is identical with the *cylindricum* of Fabr., the *Pennsylvanicum* of De Geer, the *sulcatum* of Beauvois, and the *unicolor* of Drury, which are redescriptions and renamings of Forster's *brunneum* of 1771. The figure represents an individual of the maximum size, 1.80 inch.; smaller examples measure from 0.90 inch, upward.

Hylotrupes bajulus is another of the *Cerambycidæ*. Dr. Fitch records it among the pine insects, and also as sometimes attacking the hemlock (*loc. cit.*). Dr. Thomas, formerly State Entomologist of Illinois, mentions it as occasionally seriously injurious to hemlock lumber. Dr. Harris represents it as one of the most common of its kind in the vicinity of Boston (*Insects Injurious to Vegetation*, page 100, plate 2, fig. 12). Kirby and Spence state of it that the grubs greatly injure the wood-work of houses in London — piercing the rafters of the roofs in every direction, and when arrived at maturity, even penetrating through sheets of lead which covered the place of their exit. It has probably been introduced in this country from Europe, as it is met with more abundantly near the sea-board.

Callidium sp? belongs to the same tribe with the preceding, and is of similar habits. The extent of its injuries is not recorded.

Leptura Canadensis has been taken from hemlock stumps in the Adirondack mountains. It is probably seldom injurious to living trees. I have found the beetle common on blossoms of the golden-rod (*Solidago*) at Long lake in the Adirondacks, in August.

The two longicorn borers, of which the species were not identified occurred in the bark of fallen hemlock. The smaller one (Figure 4) resembled the larva of the common longicorn pine-borer, *Monohammus confusor* (Kirby)— the most pernicious of the pine-borers. The figures are from the *Third Report of the U. S. Entomological Commission*, pl. xii., one of two plates prepared to illustrate, by enlargements and details of structure, a paper by Dr. A. S. Packard entitled "Descriptions of the Larvæ of Injurious Forest Insects."

FIG. 4.—Larva of a longicorn beetle from under hemlock bark.

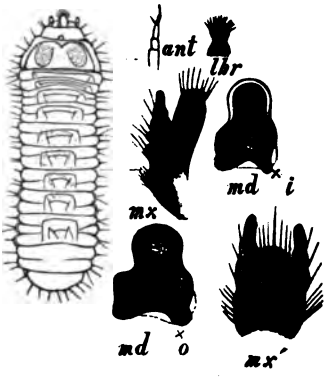

FIG. 5.—Larva of a longicorn beetle from under hemlock bark with enlargement of mouth parts.

Nyctobates Pennsylvanicus is one of the *Tenebrionidæ*, or "ground beetles." Its pupæ were found by Mr. Schaupp, on July eighteenth, in

hemlock. It probably will not prove to be a destructive species, as the group to which it belongs have their habitat under dead bark.

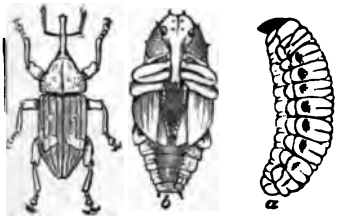

FIG. 6.—The white-pine weevil, PISSODES STROBI; *a*, its larva; *b*, the pupa.

Pissodes strobi is the notorious white-pine weevil, the larvæ of which inflict such serious injuries on young pines by infesting and destroying the topmost shoot, checking its upward growth and causing an unsightly bend at this point, as future upward growth can be continued only through one of the lateral shoots. The beauty of the trees and their value for commercial purposes are thereby greatly impaired. The operations of this beetle do not, however, prove as serious to the hemlock as to the pine, seldom producing deformation in it.

In the Annual Report of the United States Department of Agriculture for 1885, plate ix, from which the figures illustrating this insect and its operations are taken, also gives representations of remarkable deformations produced in white pines through the customary destruction of the terminal shoots by this insect attack. Figure 6 shows the beetle, its larva and the pupa. In Figure 7, the larval burrows in the sap-wood and in the heart-wood are represented at *a;* and in *b* the pupa-cases or cocoons beneath the bark removed, and the interior burrows in the heart-wood, are shown.

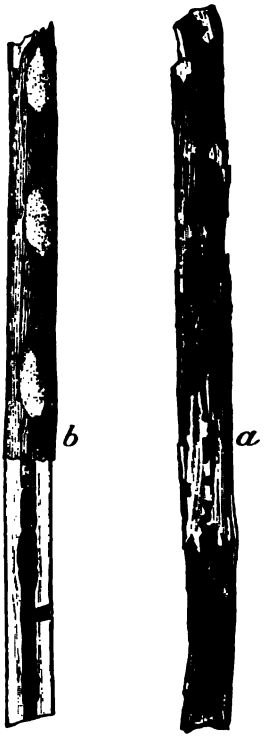

FIG. 7.—Twigs showing burrows and cocoons of PISSODES STROBI.

Crypturgus atomus, the smallest known beetle among the Scolytid beetles, was found by Dr. Packard in considerable numbers in and under the bark of standing dead hemlocks in Maine. It has also been observed in the same situation in pines, in Canada, New York and Massachusetts. It is especially destructive to spruces, as it burrows the bark irregularly, and not in the plane of the sap-wood. Its galleries are very numerous, a great many being contained within a square inch of extent.

Of the two Hemipterous insects recorded as infesting the hemlock (there are probably several other species of the order which have been

overlooked up to the present), one is the seventeen-year cicada (commonly, but improperly, called locust), *Cicada septendecim*. Its injuries are inflicted by the female boring into the twigs for the deposit of its eggs. It has not been observed to oviposit in pines (1*st Rept. Ins. Mo.*, p. 24). The other, *Lioderma ligata*, or the bound tree-bug, so named from the red band surrounding its margin, is represented by Dr. Fitch, as "sometimes clinging on this tree, and probably sucking the juices of the leaves." It may not, however, be accepted as an injurious species without further observation of its habits, as several of its near relatives are known to subsist upon the juices of other insects which infest our trees. Dr. Fitch, in his 3d Report, page 71, No. 100, includes this insect, under the name of *Pentatoma ligata*, among those which affect the leaves of grapes by puncturing them and sucking their juices. It is shown in Figure 8.

FIG. 8—The bound tree-bug, LIODERMA LIGATA (After Glover).

Of the Orthoptera, the Rocky Mountain locust, *Caloptenus spretus* (Figure 9), according to Prof. Riley, in periods of its abundance, often strips the leaves of the hemlock, arbor-vitæ, the pines, and the Norway spruce. The injury to these evergreens is serious, as they are much more sensitive to defoliation than deciduous trees. (*First Report U. S. Entomological Commission*, p. 253.)

FIG. 9.—The Rocky Mountain Locust. CALOPTENUS SPRETUS—Female.

Several of the insects noticed above are believed either to attack only sickly or diseased trees, or those already dead, yet their operations and their history may be quite as important and as deserving of observation and study as those which confine their attacks to living and healthy vegetation. This view of the comparative importance of the two classes has been so ably presented by Dr. Asa Fitch, that we quote from his *Fourth Report on the Insects of New York* (1859, pp. 2, 3), a portion of his remarks prefatory to his consideration of the Insects Infesting Evergreen Forest Trees:

"The evergreens are so highly esteemed for ornamental purposes, and some of them, particularly the pines, are so valuable on account of the timber that they yield us, that we are much interested in knowing the insects which we have in this country, which infest these trees to their injury, either by stunting their growth, marring and deforming them, or causing their premature decay and death. Fortunately for us, it is upon trees that are sickly and decaying, or upon their dead trunks and timber, that most of these insects make their

attack. Such insects are currently regarded as being of but little importance, those only which are the source of the evil, which prey upon trees which are healthy and in full vigor, causing them to become sickly and decrepit, being deemed of a character so pernicious as to merit special observation. And yet those insects which only invade dead trees and their timber, are at times occasioning serious losses, showing that they are far from being such trivial evils as we are accustomed to deem them. While this Report is in course of preparation, a casualty occurs in our midst, which furnishes a forcible illustration of the truth of this statement. I allude to the breaking of a railroad bridge over the Sauquoit creek, near Utica, on the morning of May 11, 1858, by which frightful disaster eight persons lost their lives and upwards of fifty others were maimed or injured more or less severely. We are informed by the Utica Morning Herald, in an article prepared immediately after the writer had visited the scene of the catastrophe, that the principal timbers of the bridge, though externally perfectly sound in their appearance, were profusely perforated with minute worm holes, whilst all the interior was so decayed and rotten that the slightest force sufficed to break it into fragments. This fully explains why a structure which had been so recently erected that no suspicions could be reasonably entertained of its being in the least defective and unsafe, was yet in reality fearfully so. Some one of these minute timber-beetles which subsist upon the wood of dead trees, had here its abode, multitudes of them probably mining their burrows everywhere through the interior, as is their habit, and then eating their way out to found new colonies elsewhere. As the little pin-holes which they perforate scarcely diminish the strength of the timber in the heart, they are deemed of no consequence. And yet from every shower that passes, water is admitted through these perforations to the interior of the timber, filling the multitude of little cells which these insects have there excavated, and saturating the wood as though it were a sponge. The outer surface being exposed to the atmosphere speedily dries and thus remains perfectly sound, whilst the interior continuing damp for several days, rapidly though insiduously decays. Thus the sad disaster to which we have alluded, and the destruction of property and loss of life with which it was attended, there can scarcely be a doubt, was caused by one of those minute insects, which are popularly regarded as being of trifling consequence, since they never attack living trees."

The Chalcid Parasites of Cecidomyia Betulæ Winn.

From some galls of the above species of the transformed seeds of the catkins of white birch, *Betula alba*, received from Mr. Peter Inchbald, of Fulwith Grange, Harrogate, England, three species of Chalcid parasites were obtained, which, being submitted to Mr. Howard of the Agricultural Department at Washington, were determined, generically, as *Torymus* sp., ♀, *Tetrastichus* sp., and *Entedon* sp. — one female and five males. The galls were kindly sent that they might give me their Cecidomyian inmate for comparison with our native species, but not a single one was disclosed. The parasites emerged during April sixteenth to April twenty-seventh.

Some infested catkins, which had been collected by me during the month of October 1886, also failed to give any of the producing insects, probably from having been deprived of moisture during the winter and spring, as Mr. Inchbald has stated in his letter to me, that they require moisture for their development and need to be sprinkled with water occasionally. Some galls, gathered in Albany on March twenty-first, which had begun to disclose their imagines on May fifth, also gave out quite a number of Chalcid parasites, the first of which made their appearance on April twenty-eighth. Others emerged about the middle of May, and continued to appear until the twenty-fifth of June — the last date recorded. They were quite numerous. As it would be of no little interest to compare these with the European parasites above noticed, they were also sent to Mr. Howard for his examination, who returned the following answer:

"They are different from those bred from the English specimens. It will probably be necessary to found a new genus of the *Pteromalinæ* for them. In some characters they come close to *Merisus*, of which Professor Riley has bred and described two species from *Cecidomyia destructor* [*Proc. U. S. National Museum*, viii, 1885, pp. 413, 416] but the metanotal and claval characters separate them from this genus."

Isosoma hordei (Harris).

The Joint-worm Fly.

(Ord. Hymenoptera: Fam. Chalcididæ.)

Harris: in New Eng. Farmer, ix, July 23, 1830, No. 1, p. 2 (original description); Treat. Ins. New Eng., 1852, p. 441; Ins. Inj. Veg., 1862, pp. 551–561 (as *Eurytoma h.*); Ent. Corr., 1869, p. 361 (*Ichneumon h.*).

Fitch: in Trans. N. Y. St. Agricul. Soc., xxi, 1862, pp. 830–851; 7th Rept. (in 6th–9th Repts.) Ins. N. Y., 1865, pp. 144–165, pl. 1, fig. 1 (as *Eurytoma tritici, E. hordei,* and *E. secalis*).

WALSH: in Pract. Ent., i, 1865, pp. 10–12, p. 37–8 (what it is); Amer. Ent., ii, 1870, p. 329–30, figs. 3, 4 (referred to *Isosoma*).

WALSH-RILEY: in Amer. Ent., i, 1869, pp. 149–158 (figures, nat. hist., parasites, varieties, etc.).

BETHUNE: in Ann. Rept. Ent. Soc. Ont., for 1871, pp. 59–61, figs. 58, 59.

LINTNER: in Count. Gent., xxxix, 1874, p. 584 (mode of attack); id., xlix, 1884, p. 857 (as *Isosoma tritici*).

PACKARD: in 9th Rept. U. S. G.-G. Surv. Terr., 1877, pp. 693–695.

COOK: in Rural N. Yorker, xliv, May 9, 1885, p. 314 (as *I. nigrum* n. sp.); in Amer. Nat., xix, 1885, pp. 804–808 (as *I. ? nigrum*).

RILEY: in Rur. N. Yorker, xliv, June 20, 1885, p. 418, fig. 215 (in Ohio); in Rept. Commis. Agricul., for 1886, pp. 539-542; in Encyc. Brit., Amer. Edit.—Agriculture, page 139, fig. 18.

COMSTOCK: in Count. Gent., lii, 1887, p. 529 (life-history, remedies, etc.).

Pieces of wheat straw showing insect attack, were received from Mr. C. H. Boyd, of Johnson's Creek, Niagara county, N. Y., on September fifth. They had been taken from a mow as a sample of much of the straw in it. The attack was new to those to whom it had been shown, and it was learned that it was quite common throughout Niagara county.

The straw contained the larvæ, apparently about full-grown of the joint-worm fly, *Isosoma hordei*. The larvæ were small, about one-tenth of an inch long, footless, of a yellowish-white color, and embedded in elongate cavities in the stalk near one of the lower joints, converting that portion into a hard, woody substance. Their location within could be detected by a smooth, elongated, and more or less swollen portion of the stalk immediately over them, appearing as if slightly blistered.

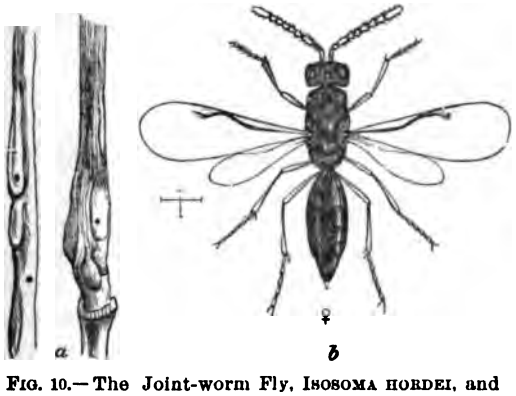

FIG. 10.—The Joint-worm Fly, ISOSOMA HORDEI, and its galls.

Sometimes these swellings are larger, more prominent and gall-like, as in the pieces of straw illustrated in Figure 10, at *a*, in their natural size. The perfect insect that emerges from them through the small round hole shown in some of the galls, is represented in enlargement at *b*.

In the portion of the plant infested, and also occasionally, in the deformation, swelling, and bending over of the stalk, the joint-worm

attack resembles that of the Hessian fly, *Cecidomyia destructor* — a more common and better known insect. The two, however, need not be confounded.

While the joint-worm is imbedded *within* the straw, the larva of the Hessian fly invariably lives *outside* of it, between the straw and the sheath, at the joint. The "flaxseeds" which are found in this position are the larvæ of the Hessian fly transformed into pupæ, and are unfortunately, too familiar to many of our farmers.

Joint-worm Injuries.

It is a destructive insect, not only to wheat but also to rye and barley. A few years prior to 1829 and 1830, when the first notices were published of it, it had proved so injurious to barley in some portions of Massachusetts as to compel the abandonment of the cultivation of that crop. Many fields failed to yield the amount of seed sown. Dr. Harris described the new insect, in 1830, and named it from the plant on which it occurred, *hordeum* being the Latin name for barley.

Its Further History.

Its early history is detailed in Harris' "Treatise on Insects Injurious to Vegetation," pp. 551–561. Its ravages did not long continue in Massachusetts, for after the year 1831 it ceased to attract particular attention. Later, it became destructive in Virginia, where it occasioned such serious losses that, in 1854, a "joint-worm convention" was held at Warrenton, to discuss the insect and learn the best remedies that could be employed against it.

In 1852, it was observed in some of the central counties of the State of New York, when it was brought to the notice of Dr. Fitch, Entomologist of the N. Y. State Agricultural Society, who gave it careful study, and in 1859, from variations in colors of specimens examined, named and described as new species, *Eurytoma tritici* and *Eurytoma fulvipes* — the first from wheat, the other from barley. Later, from specimens infesting rye in Eastern Pennsylvania, he described *Eurytoma secalis*. But each of the above three (for an account of which see his *Seventh Report on the Insects of New York*, published in the *Transactions of the N. Y. State Agricultural Society*, vol. xxi., 1862, pp. 830–851) have been pronounced only colorational varieties of *Isosoma hordei* (Harris).* See Walsh-Riley in *American Entomologist*, i, pp. 152-153.

* If the antennal features of the "yellow-legged barley-fly," *Eurytoma fulvipes*, have been correctly given by Dr. Fitch, namely: In the male "the antennæ are thread-like or of equal thickness through their whole length, and thinly bearded with short robust bristles," whereas, in *Isosoma hordei*, "the joints are surrounded by whorls of hairs" — then *Isosoma fulvipes* will be entitled to retain its designation as a valid species. It does not appear that it has been observed since its description."

Within a few years, after a long cessation, apparently, of its depredations among us, this insect has again appeared, resumed its destructive work, and caused attention to be drawn to it.

In the year 1884, it was observed to abound to a considerable extent in portions of Ohio, in wheat straw that was being threshed.

Recent Attacks in New York.

In the autumn of 1884, examples of infested straw and injured wheat grown thereon, were received from the farm of Mr. Robert J. Swan, of Geneva, N. Y. The injury committed had been severe, involving, it was stated, nearly a total loss of the crop. Large numbers of the larvæ were found imbedded in the straw near the lower joint — eleven in one piece of an inch and three-fourths in length; and of the wheat, only about one per cent of the kernels was fully developed — a large proportion of the grains being shrivelled, and nearly one-half were so light in weight as to float when dropped in a glass of water. If the sample sent was a fair representation of the infested field, it would appear to have fallen from sixty to seventy-five per cent below its normal yield.

From an examination of the straw and the contained larvæ, the insect, in this case, was believed to be identical with *Isosoma tritici*, which had been discovered in wheat in Illinois, in 1880, and was so named and described by Professor Riley in the *American Naturalist* for March, 1882. A notice of the attack by the above named insect, as new to the State of New York, was communicated by me to Dr. Sturtevant, of the N. Y. State Agricultural Experimental Station, and published as Bulletin No. C [100] of the Station. When, in the following spring, examples of the perfect insect emerged from the straw, they proved to be, not the species supposed, but our old acquaintance, *Isosoma hordei*.

In 1886, the insect occurred abundantly in the vicinity of Ithaca, Chemung Co., N. Y. Some straw that was being used for making paper at the paper mill in Ithaca, was found to be unsuitable for the purpose, from the woody nature of some portions of it. On examination at the mill, small insects were discovered in these woody pieces, which, being submitted to Professor Comstock, of Cornell University, were readily identified by him, as the joint-worm, *Isosoma hordei*. About one straw in twenty-five was infested.

How it may be Discovered.

When the insect abounds in the straw, and many are contained in a single stem, they frequently cause the stalk to curl and bend over at the infested point; but often the external appearance is unaltered.

except to careful and intelligent observation. The presence of the insect has in several instances first been detected at the time of threshing, when many of the hardened and wooden portions of the straw containing the larvæ, in pieces measuring from a half-inch to three inches in length, are broken off, and by their weight are carried from the threshing machine with the grain.

The Fly Seldom Seen.

The winged insect into which the joint-worm develops, is so small and delicately formed (being but about one-eighth of an inch in length) that it would probably escape notice, unless it be sought for by inclosing some of the infested pieces of wheat straw which has had its ordinary winter exposure, in a tight box or jar, about the middle of May. During the latter part of the month the imprisoned insect, having attained its maturity, will eat a small round hole outward from its cell, and emerge as a shining black little creature with four transparent, almost veinless wings, and with legs entirely black or having more or less yellow on them. Dr. Fitch compares it in general appearance to a small ant. Figure 11 represents the male and female "fly," with enlargements of the abdomen and antenna, which differ so conspicuously as readily to indicate the sex.

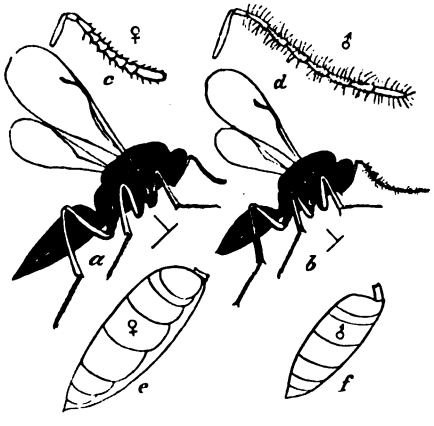

FIG. 11.—Male and female of ISOSOMA HORDEI.

What the Insect is.

It belongs to the order of Hymenoptera, of which are the bees, wasps, ichneumon flies, etc., and to the family of *Chalcididæ*. The species of this group are very numerous — perhaps a thousand existing in this country alone. They are minute forms, and usually occur as parasites, living, in their earlier stages, within the bodies of other insects, and the family is, therefore, regarded as holding high rank among our beneficial insects. The genus *Isosoma*, however, is an exception, as its members are vegetable feeders, living upon growing plants and often producing galls in them.

Reasoning from its family relationship, which, as a rule in the insect world, is attended with a general uniformity in habits, both Drs. Harris and Fitch, for some time during their simultaneous study

of *Isosoma hordei* (referred by them to the parasitic genus *Eurytoma*), were of the belief that it must necessarily be parasitic, and that its occurrence within the straw was that of a destroyer of the real cause of the injury, which they supposed to be a dipterous insect—a *Cecidomyia*, allied to the Hessian fly.

The parasitism of *Isosoma* is not yet entirely removed from the sphere of discussion and doubt, for although it may be claimed as effectually disproved by recent observations upon its actual oviposition, it is still maintained by eminent European writers.

Other Species of Isosoma.

The associates in the genus of the joint-worm fly are not numerous. The following have been described:

Isosoma tritici, described by Professor Riley, in 1882,* from specimens obtained in Illinois and other Western States, and found feeding singly within the upper joints of wheat. In some publications it has been named the "wingless joint-worm fly," as nearly all the examples are without wings, or having them greatly aborted. This species should not be confounded with *Eurytoma tritici* of the Fitch Reports (vii, pp. 144–155 of vi–ix), which has been referred to *I. hordei*, as before stated.

Isosoma grande Riley,† named the "larger wheat fly," as it is a larger and stouter form than its congenors. Its habits and general features are so much like those of *I. tritici* that it is thought it may prove, upon further study, to be but a dimorphic form of that species. In its original description, in the Report of the Department of Agriculture for 1884, page 358, it is described by comparison with *I. tritici*, from which its principal differences may be seen. No males have yet been found of either. Figure 12 is a representation of *I. grande*, much enlarged.

FIG. 12.—ISOSOMA GRANDE—female.

Isosoma elymi French,§ feeding in the middle internodes of *Elymus Canadensis*—a perennial grass of

* *American Naturalist*, for March, 1882, xvi, p. 248.
† *Bulletin of the Brooklyn Entomological Society*, for December, 1884, vii, p. 111.
‡ *Canadian Entomologist*, for January, 1882, xiv, p. 10.

river banks, meadows, and rich shaded woods of the Southern and Western States, and sometimes known as "wild rye."

Isosoma vitis Saunders,* known as the "grape-seed insect," the larva of which, represented in natural size and in enlargement in Figure 13, feeds within the seeds of grapes before the ripening, causing the fruit to shrivel and fail of maturing.

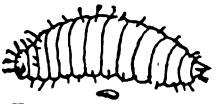

Fig. 13.—Larva of the grape-seed midge, Isosoma vitis.

Remedies.

It is fortunate that we have at our command means for controlling the depredations of this insect, which are simple, easy, and inexpensive.

Since its entire life, from its hatching to its emerging in its perfect state, is passed within the straw and in quite a limited locality therein, it is evident that if the straw be destroyed by burning, or by any other as effectual a method, at any time prior to the emerging of the winged insect, the entire brood will be destroyed with it.

If the grain is not cut unusually close, a large proportion of the larvæ will be left in the stubble. The stubble of an infested field should be burned over at any convenient time favorable for the burning. There is not the objection to this expedient in this case, that may properly be urged against burning for the Hessian fly — that it destroys the many parasites which render such excellent service in reducing its numbers — for the known parasites of the joint-worm are but few, and thus far they have proved of but little value in its reduction. Dr. Harris has justly remarked: "We need not be restrained by the consideration that the diseased straw contains also some truly parasitical larvæ; for these are very few in number compared with the immense swarms of the *Eurytoma* [*Isosoma*] that are annually produced. If we can succeed in exterminating these destroyers, we shall have no occasion for the services of the parasites." In figure 14, its principal parasite, *Semiotellus chalcidiphagus* Walsh, is figured in both sexes. *Eupelmus Allynii* (French) is also parasitic upon it, but to a much more limited extent.

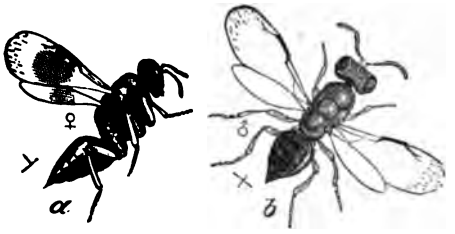

Fig. 14.—Joint-worm Parasite, Semiotellus chalcidiphagus — female and male.

It is believed that a *deep* plowing under of the infested stubble

* *Canadian Entomologist*, ii, 1869, pp. 25-27. *Country Gentleman*, for September 21, 1876, xli, p. 599. *Entomological Contributions*, iv [Lintner] 1878, pp. 24-28.

would be fatal to the contained larvæ, and almost as effective as burning. An *ordinary* plowing was found ineffective in Massachusetts, as the insects having only been buried to a moderate depth, completed their transformations and made their way to the surface.

The broken-off, hardened pieces of the straw, observed as before stated in threshing and cleaning, should be carefully collected and burned. The grain should also be examined for these pieces and picked out by hand.

Examination should be made of the threshed straw, and if the larvæ are found therein, it should be destroyed, either by feeding or some other consumption of it, before the ensuing spring. Dr. Harris records an instance where so many of the insects infested a straw-bed in Cambridge, Mass., that they proved troublesome to children sleeping in the bed — their bites or stings being followed by considerable inflammation and irritation, which lasted several days. So numerous were they, that it was found necessary to empty the bed-tick and burn the straw.

Another Species Associated with I. hordei.

This report not having been published in compliance with the law that requires the printing and presentation to the Legislature on or before the first day of February of each year of all State Reports — the delay in its appearance has permitted the addition of the following note:

The attack on the wheat straw noticed on page 148, and there identified, from the appearance of the larvæ and characters of their cells, as that of *Isosoma hordei*, proves not to have been confined to that species.

During the month of March, 1888, from some infested wheat straw received from Mr. Boyd, on December 14, 1887 (a second sending), which had subsequently been kept in a jelly glass, forty specimens of Isosomas emerged. Of these, nine examples were characteristic *Isosoma hordei* — one male and eight females. The others were evidently a different species, as they were of a larger size in both sexes, — the abdomen of the female distinctly angulated at the base of the ovipositor, and prolonged conically in an acute point, and with the veins of the anterior wings whitish, instead of black as in *I. hordei*. Nine of these were males (in some of the species of Isosoma the male, as before stated, is not known), and twenty-two females.

The Associated Species is Isosoma captivum.

On submitting examples of the above to Professor Riley, they were recognized as a species which had been collected abundantly in Illinois and Indiana in sweeping with a net in fields of blue grass,

timothy, and rye, but had not been reared from its food-plant. Professor Riley has given it the manuscript name of *Isosoma captivum* and will shortly give description and illustration of it.

From the straw received from Mr. Boyd in September of 1887, and kept during the winter in a paper box, none of the insects were obtained. A few of the cells — less than a half-dozen, had given out the imago, but they had escaped from the box. The larger number of the cells show at the present time, invariably at the upper end, the black head of the dead insect within the open round hole that had been eaten for its escape; in the remainder, a blackish spot indicates the head beneath the thin film of straw covering it. The death of nearly all the insects was doubtless the consequence of the straw having been kept for three months longer than in the other instance, within a warm room. The straw was badly infested. In one piece — within two inches of the joint, eleven cells were counted — six open and five closed.*

No parasites were obtained from the straw.

Thalessa lunator (Fabr.).

The Lunated Long-Sting.

(Ord. Hymenoptera: Fam. Ichneumonidæ.)

Ichneumon lunator Fabricius: Spec. Ins., i,1781, p. 430, No. 64; Mant. Ins., i, 1787, p. 266, No. 76; "Ent. Syst., ii, p. 162."

Pimpla lunator Harris: Treat. Ins. N. Engl., 1852, p. 427; Ins. Inj. Veg., 1862, p. 538, fig. 251 (reference to).

" " Glover: in Rept. Com. Agri. for 1866, p. 41 (brief mention).

" " Walsh-Riley: in Amer. Entomol., i, 1868, p. 59; id., ii, 1870, p. 96 (as *Rhyssa*.)

Rhyssa " Packard: Guide Stud. Ins., 1869, p. 196, fig. 128, of male.

Thalessa " Cresson: in Trans. Am. Ent. Soc., iii, 1879, p. 169; Synop. Hymenop. N. A., 1887, p. 215 (in list).

Rhyssa " Quay: in Amer. Entomol., iii, 1880, p. 219 (oviposition).

" " Fletcher: in 11th Rept. Ent. Soc. Ont. for 1880, p. 67 (brief notice).

" " Harrington: in Canad. Entomol., xiv, 1882, p. 82; the same in 13th Rept. Ent. Soc. Ont. for 1882, pp. 23-25.

" " Clarkson: in Canad. Entomol., xiv, 1882, p. 223; in Bull. Brook. Entomolog. Soc., vii, 1885, p. 124 (oviposition).

" " Riley: in Science, iv, 1884, p. 486 (not lignivorous); in Bull, Brook. Entomolog. Soc., vii, 1885, p. 123.

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*These were subsequently opened with a knife and a perfect imago removed from each, three only of which were males; all were *Isosoma captivum*.

Pimpla lunator GADE: in Bull. Brook. Ent. Soc., vii, 1884, pp. 103-4 (sexual attraction and oviposition); in Science, 1884, No. 92, p. v.
Thalessa " LINTNER: in Count. Gent., xlix, 1884, p. 331 (general notice).
Rhyssa " SMITH: in Bull. Brook. Entomolog. Soc., vii, 1884, p. 125 (remarks on oviposition).

The singular appearance presented by this large Ichneumon fly, in its long extended ovipositor and lateral guides proceeding from the end of its abdomen, looking, particularly when in flight, as if some thread or other fibre had become accidentally fastened to it, never fails to excite curiosity, and often is the occasion of its being brought to the entomologist as a supposed rare insect.

It is a common insect in the State of New York, and in other of the northern states, and extends over a large portion of the United States.

A living example of it was received from Augusta, Georgia, taken on April 1, with its ovipositor inserted in a shade tree, from which it could with difficulty be drawn. Numbers of it had been noticed the preceding year, when they occurred somewhat later, and continued for about ten days or two weeks. The date of the capture of the specimen would seem to be an unusually early one, even for the southern states, and the present record is therefore made of it.

It is not unusual to meet with this insect fastened by its ovipositor to the tree so firmly that it is not able to disengage itself. Numbers of dead individuals have been seen suspended in this manner from a single tree. The insect has occasionally been met with while engaged in ovipositing, in remarkable abundance. In one instance recorded, "the bark of a large tree from which the top had been broken, was dotted all over with *lunators*, often massed in rows or patches, so that there must have been several hundreds present." A few males (usually quite rare) were among the number. Figure 15, is an indifferent representation of the male, but it will serve to show the long and slender form of the abdomen, which is flattened above, and black, without the yellow bands that characterize the female.

FIG. 15.—THALESSA LUNATOR—male.

Its Different Names.

This curious insect, one of the largest of our Ichneumons, originally described by Fabricius as *Ichneumon lunator*, is figured and briefly referred to by Dr. Harris, in his *Insects Injurious to Vegetation*, as *Pimpla lunator*. Later writers have referred it to the genus *Rhyssa*, but Mr. Cresson, in his recent arrangement of the group, has separated it from that genus and placed it in *Thalessa*, of Holmgren, together with four other United States species, one of which is the common "black long-sting," or *T. atrata*. The specific name of *lunator* is drawn from the yellow crescents (shown angular in the figure) which mark the sides of the abdomen, one upon each segment.

Description.

The insect has been described by Mr. Harrington (*loc. cit.*) as varying much in size, the larger specimens being fully twice as large as the smallest ones. The body varies in length from three-fourths of an inch to one inch and a half, and bears at its posterior extremity an ovipositor projecting from one and one-half to three and three-fourths inches.

The head of the female is yellow, with a dark band on its summit, in which are inserted the three ocelli between the eyes, parallel to which and posterior to it runs another dark line which almost encircles the head; lines also run from the base of the antennæ to the mandibles. The slender antennæ are dark brown, many jointed, and about an inch long. The thorax and abdomen are dark brown, ornamented with lines and bands of yellow, which is also the color of the legs. The abdomen is gradually flattened laterally toward its extremity, where it is broadly dilated. The front wings expand from one and one-quarter to two and one-half inches, and have a quadrangular dark patch on the anterior border, and a brown patch at their tip. The black ovipositor, given out from the fifth segment beneath, varies in different sized individuals, from one and one-half to three and three-fourths inches in length, and is flattened on its sides. Its two guides of nearly the same length and proceeding from the extremity of the abdomen are broader, and are channeled for the reception of the ovipositor and for holding it when serving as supports.

Is not Injurious, but Beneficial.

Contrary to the belief of many of those who have seen the operations of this insect and who entertain the opinion that all of the boring insects are harmful to the vegetation that they attack, this one is not only not injurious, but it renders excellent service in the destruction of a noted pest of several of our shade trees. It is from

its large size and peculiar appearance, a distinguished member of the large family of *Ichneumonidæ*, the province of whose members it is to prey upon other insects, often so effectively as to rid us of some of our greatest insect scourges, when all human efforts to arrest their multiplication and injuries have been of no avail.

It Preys upon Tremex columba.

The trees in which *T. lunator* is often seen inserting its long ovipositor for the deposit of its eggs, are largely infested by the grubs of the pigeon Tremex, *Tremex columba* Linn., upon which the larva of *T. lunator*, preys. The perfect insect is a large, wasp-like creature, as shown in Figure 16, with narrow, semi-transparent, smoky-brown wings, a reddish head and thorax, and a long, cylindrical, black body, marked with seven yellow bands, most of which are interrupted on the middle. The body bears beneath a black ovipositor of about an inch in length, projecting three-eighths of an inch beyond its tip, held in place by two guides — the whole forming a stout, horn-like instrument, whence we have the common name of "horn-tails" for this insect and its associate *Urocerida*. The Tremex larvæ run their large and destructive burrows in the trunks of the maple, beech, elm, oak, sycamore, apple, pear, etc., not infrequently causing the death of the tree when the attack has been long continued.

FIG. 16.—The Pigeon Tremex — TREMEX COLUMBA,—female.

How Thalessa Oviposits.

The operation of boring for oviposition has been described by Mr. Harrington, as follows:

Sitting upon the bark where perforations mark the exits of previous occupants, she runs around until she finds a promising spot, as, for instance, the hole made by a Tremex in depositing her eggs. Placing herself so that the tip of the abdomen will be above the orifice to be probed, she makes herself as tall as possible, and, by elevating her abdomen and carrying under the ovipositor, succeeds in inserting the tip of the latter in the hole.

If the dorsal surface of the abdomen be examined, there will be observed, between the sixth and seventh segments, a gap closed by a whitish membrane. This marks an admirable contrivance to enable the insect to use her seemingly unwieldy weapon, for the membrane is so dilatable as to be capable of forming a cavity in the posterior part of the abdomen, in which can be coiled a large portion (more than one-third)

of the ovipositor, which thus becomes perpendicular under the insect, where it is guided and supported by the sheaths, which bend up in loops over her back. By vigorous muscular contractions of the sac, the delicate ovipositor is slowly forced down the larva's burrow, often to its full extent.

In the accompanying figure, the insect is represented in the attitude above described, with her ovipositor emerging from the lower angle of the end of the abdomen, already thrust some distance into the wood, while held in position, braced and guided by the two stouter guides, which, given out at the upper angle, are curved upward over the abdomen, and downward along its sides.

Fig. 17.—The Lunated Long-sting, Thalessa lunator—female ovipositing.

The above observations of Mr. Harrington, are supplemented by those of Mr. J. Quay (*loc. cit.*), which, from the interest attaching to the operation, we also quote:

I observed that after raising the abdomen as far as possible, the drill was worked forward so as to slightly bend under, giving the insect a purchase on same. Then followed a bearing down motion on the bent tube, curving the end of the abdomen forward and upward, and next forcing the ovipositor, near its attached end, to curve also and pass up through the abdomen and above into a cavity which there opened for its reception. The cavity was inclosed by a membranous sack, capable of great distention, and while the drill was being continually forced up through, it curved about within the sack forming one complete bend of about three-fourths of an inch in diameter, and another partial one. When fully distended the sack was very thin, quite transparent, and seemingly upon the point of bursting apart. But the ovipositor was in this manner brought to the edge of the worm-hole, was slipped in, and thus made to ease away upon the distended sack which by collapsing forced out again the drill by its mere force of contraction, and the coil now soon disappeared.

Another writer has stated: "The long ovipositor is passed between the posterior legs, the abdomen is elevated almost to a right angle with the thorax, and the ovipositor guided by the anterior tarsi is forced with a ramming motion into the wood to the depth of from two to three inches." (Dade.)

Its Eggs Not Placed in Tremex Burrows.

The purpose of the long ovipositor has generally been stated to be for insertion and penetration in the burrow made by the horn-tail borer, the *Tremex columba* above referred to, its extraordinary length (from three to five inches) enabling it to reach the larva of this insect and deposit an egg within it. Although this statement is to be found in all books treating of this insect and its habits, it was a few years ago, for the first time we believe, questioned, by a writer in the *Canadian Entomologist* (vol. xiv, 1882, page 223), Mr. F. Clarkson. This gentleman there asserts that in every instance observed by him, "the ovipositor, instead of penetrating through the burrow of a *Tremex* or other wood-borer, entered through wood that had not been previously attacked." This was shown by repeatedly "cutting off, to the depth of six inches, such portions of the stump as had been attacked, but failing to detect in any of the cuttings either the burrow or larva of *Tremex* or other larva." He suggests that possibly the larva of *Thalessa* that would hatch from the buried egg, may have the power of boring in search of its food.

Does Thalessa Oviposit in Exposed Larvæ?

In a communication made by me to the *Country Gentleman* of July 12, 1883 (page 561), upon "Rhyssa atrata," after noting the above observations of Mr. Clarkson, I wrote as follows:

"The question is therefore raised — are the commonly accepted habits of the 'long-stings' correctly given? Has any one actually seen them in the act of probing the burrows of a *Tremex?* Such an operation has never come under my observation, while probably all field entomologists have repeatedly found them fastened by their ovipositor firmly inserted in apparently solid wood. I recall an instance observed by me several years ago, when what I think must have been *Rhyssa lunator*, was earnestly engaged in placing its eggs in the following singular manner in a colony of a species of *Datana*, feeding upon a branch of hickory: Its ovipositor was bent beneath it, extending between its legs, with its tip projecting in front of its head, enabling it with perfect ease to select one caterpillar after another for the reception of its eggs. Why would not this be a much better method of using the long ovipositor than the one generally ascribed to it? There would certainly be no haphazard work in such oviposition, or any waste of material. In the instance above recorded, each thrust told, as was seen in the well-known alarm-jerk of these larvæ, at once communicated from the

victim to the entire group. Unfortunately, the importance of the observation was not known to me at the time, and no further attention was given to it."*

Its Oviposition and Larval Habits.

Professor Riley, referring to my remarks as above published, kindly gave me the following interesting statement of his observations upon the habits of this species, which adds so much to our previous knowledge of the insect, that I take the liberty of inserting his note, written under date of July 15, 1883:

"I have on several occasions had opportunity of closely studying not only the mode of oviposition, but of larval growth of *Rhyssa*. My sketches and notes are at home [written from Boscawen, N. H.], but the salient facts bearing on your question I can give from memory. In all instances, where I have found the female depositing, it has been in trees infested with *Tremex columba*, and I have found her most numerous on badly affected or injured trees, or even on stumps or broken trunks already partly decayed. The instinct to reach the egg or larva of Tremex, so dwelt upon in popular accounts, is imaginary. She bores directly through the outer parts of the tree, and doubtless probes for a burrow; but her egg is consigned anywhere in the burrow; the young larva seeks its prey, and lives and develops without penetrating the body of its victim, but fastened to the exterior. This habit among parasites is much more common than is generally supposed. A great many *Rhyssa* larvæ doubtless perish without finding food, and a great many females die in probing for a burrow, especially when they burrow through wood that is sound and hard."

Other Species of Thalessa.

But three other Thalessas, beyond the two mentioned in the foregoing, are recorded in our lists, viz.: *T. Quebecensis* Prov., from Canada; *T. nitida* Cresson, from Canada and Virginia; and *T. Nortoni* Cresson, from Canada and Colorado. Of the last-named species, described in *Proceed. Entomolog. Soc. of Phila.*, iii, 1864, p. 317, and characterized by its transparent, unspotted wings, the semicircular yellow dorsal spot on the first and second segments, and the large, rounded, yellow spot on the sides of each of the third, fourth and fifth segments — a single example (the only one

*An identical operation of either this species or by the black long-sting, *T. atrata* — judging from the careful description of the insect and its subsequent identification of the form in my collection, has been observed and narrated to me by Mr. J. S. Woodward, Secretary of the New York State Agricultural Society. The ovipositor was extended between the legs, reaching in front of the insect, and was being used on a colony of caterpillars upon a limb, the species of which was not known to the observer.

known to me) was taken by me on August 22, 1883, in the Adirondack mountains, at Elk Lake, Essex county, N. Y.; altitude, 2,000 feet, approximately.

Amphibolips prunus (Walsh).

The Oak-plum Gall Cynips.

(Ord. HYMENOPTERA: Fam. CYNIPIDÆ.)

WALSH: in Proceed. Ent. Soc. Phila., iii, 1864, p. 639, note.
WALSH-RILEY: in Amer. Ent., i, 1869, p. 104, figs. 80, 81 (as *Cynips*).
ASHMEAD: in Trans. Amer. Ent. Soc., xiv, 1887, p. 130.
CRESSON: Synop. Hymenop. N. A., 1887, pp. 175, 178.

Galls of this insect, growing from the cup of an acorn, were sent for name and information, October 26th, by Mr. Augustus Floyd, from Moriches, N. Y., where they have been numerous this year. From ridges within the cup, looking like elongate blisters, and from a rupture or disarrangement of the scales on its outer side opposite to these, it appears that six galls had been attached to the one cup. Five were received, which measured from four-tenths to five-tenths of an inch in diameter, of a dark brown color, and wrinkled like a dried plum, except somewhat finer. They were of a leathery texture, but could be cut through without difficulty, disclosing the suboval, smooth cell within of about one-tenth of an inch in diameter. The first one opened contained a number (perhaps ten) of white larvæ, closely twisted together in a ball, and filling the cell. They were evidently parasitic on the cynips larva, and apparently dipterous. But one other of the galls was opened for examination, and that showed the cynips larva.

The gall was first described by Mr. Walsh, as *Quercus prunus*, in the *Proceedings of the Entomological Society of Philadelphia*, for 1864, from specimens found in August and September, on *Quercus rubra* and *Q. tinctoria*.

In an extended valuable paper on "Galls and their Architects," published in the *American Entomologist* for February, 1869, by the editors, Messrs. Walsh and Riley, this peculiar gall and the insect producing it, are noticed and figured. Their brief account (omitting the scientific description of the insect) and the figures are herewith given.

"The oak-plum gall is remarkable for being the only American gall that is known to grow out of the acorn. It occurs indiscriminately

upon black and red oak, reaching maturity in August and September. At that period it is solid but fleshy, and when cut into is a pink color inside, shading into yellow toward the middle. Subsequently, as it dries, it becomes so hard as to be cut with difficulty, its color inside changing first to black-red, and afterward to brown. The insect that produces this gall (*Cynips q. prunus*, new species) makes its appearance in April, and is remarkable for lying two years in the gall before it eats its way out, remaining in the larva state over a year: indeed, some of them remain in the larva state for over two years, and do not eat their way out until the end of the third year. Figure 18, *b*, shows the same gall when cut open, and *c*, the central cell inhabited by the larva."

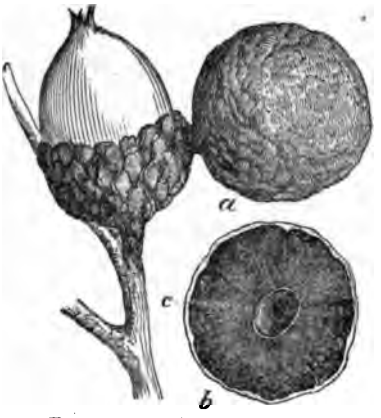

FIG. 18.—The Oak-plum gall of AMPHIBOLIPS PRUNUS.

New Generic Reference.

In Mr. W. H. Ashmead's paper on the "Cynipidous Galls of Florida," giving synopses of the described species of North America (*loc. cit. sup.*), this species is referred to the genus *Amphibolips* of Reinhart (*Berl. Ent. Zeits.*, 1865, 10). This is in conformity with the classification given by Dr. Mayr, in his "Genera der gallenbewohnenden Cynipiden," published in 1881, based on a special study of the European species and a large number of American forms. It has been accepted in the arrangement and nomenclature of the *Cynipidæ* in Mr. Cresson's recent *Synopsis of North American Hymenoptera.*

Description of the Insect.

The insect is shown in Fig. 19, in enlargement. Its head is rough; face pubescent; antennæ exceeding half the length of the body; thorax coarsely punctate with a conspicuous dorsal groove; abdomen, second joint polished with rather large shallow punctures on its basal three-fourths; joints 3–7, densely covered with small confluent punctures, giving a silvery appearance; legs rufous; tips of tarsi black; wings subhyaline; on the front wing, a dark brown cloud extending from the first cross-vein over the upper portion of

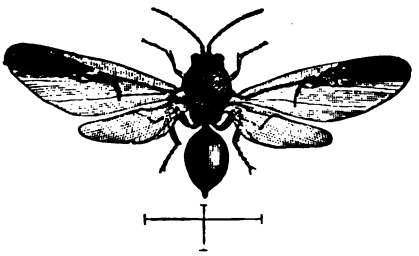

FIG. 19.—The Oak-plum gall Cynips, AMPHIBOLIPS PRUNUS.

the wing to its apex; veins brown. Expanse, 0.47–0.65 in.; length, ♀, 0.20–0.30 in.

For a more detailed description, see *American Entomologist*, vol. i, 1869, p. 104, from which the above is abridged.

A Second Acorn-cup Gall Insect.

Since the publication of the above, as the only American gall that is known to grow out of the acorn, a second species has been described by Professor Riley, as Cynips gall, *Quercus glandulus*. It differs from the above conspicuously, in that the new gall is more or less completely imbedded in the cup. It is a pip-like body, averaging, when well-developed, one-fifth of an inch long by about one-half so broad; its sides are either parallel or slightly bulging, more or less deeply corrugate, and of a whitish-green color. The larva occupies a cell near the flattened or slightly concave nipple-tipped crown. The insect has not been described. The gall occurred in October, at Toughkenamon, Pa., on a shade-tree of *Quercus bicolor* in a pasture. Two-thirds of the acorn cups were affected. (*Transactions St. Louis Academy of Science*, vol. iii, 1887, p. 577–8.)

This species appears to have been overlooked (or perhaps omitted from want of knowledge of the insect) by Mr. Ashmead, in his paper above cited. In the Cresson Synopsis, it stands as *Cynips? glandulosus* Riley.

Aulacomerus lutescens *n. sp.*

The Poplar Saw-fly.

(Ord. HYMENOPTERA: Fam. TENTHREDINIDÆ.)

Larval Habits.

A number of saw-fly larvæ were discovered in the early part of June on a small poplar, *Populus monilifera*, in my garden, feeding in parallel rows side to side on two leaves, which had apparently been eaten from the tips downward. On the foot-stalk of the leaves the scars of the egg-deposit from which they had been hatched were seen, to the number of thirty in one and twenty-eight in the other. They were probably the oviposition of one female. They fed heartily and rapidly, abandoning one leaf when all but so much of the basal parts as would afford them a convenient footing had been consumed, and then passing to another. Some of the stronger veins were left uneaten. Their social habits continued to maturity, although as they approached this period, they separated into smaller groups, and would at once do so if disturbed by the act of removing some of them *from the leaf.*

Description of the Larvæ.

When near maturity, they were seven-tenths of an inch long, of an orange-yellow color, with two rows upon the back (subdorsal) of twelve large irregularly rounded black spots, of which the middle ones are the larger, measuring in diameter about one-half the length of the segment. There is also a row on the side (stigmatal) of twelve smaller black spots, of which the two anterior ones are the largest, and semicircular in form. Numerous short white hairs are given out from two transverse rows of tubercles on each segment, the longest of which about equals one-half the diameter of the body. The head is black superiorly and laterally, with a central black spot in front surrounded with brown. The tarsal hooks are brown.

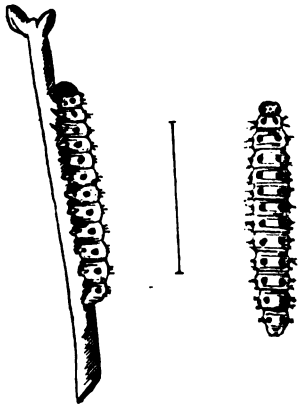

FIG. 20.—Larva of the poplar saw-fly, AULACOMERUS LUTESCENS.

Figure 20, shows the larva in a dorsal and in a side view.

On the twenty-fifth of June the larvæ commenced to spin up in irregular shaped cocoons, between the leaves on which they had been feeding. Ground had been given them in which to bury, if so inclined, but it was refused. By the twenty-seventh they had all made their cocoons. The perfect insects emerged July 13–18.

Description of the Saw-Fly.

The following memoranda of the more prominent characters of the saw-fly are hastily drawn up, to serve the purpose of identification, until proper description can be made:

Head, shining black, short, broad, not so wide as the thorax; antennæ brown, the seven long joints are slender, tapering regularly to the last. Thorax black above, yellow laterally and beneath, except posteriorly where it is black. Abdomen yellow, distinctly incised, short, flat, subovoid; legs yellow. Wings yellowish toward the base and particularly on the costa; the stigma large, conspicuous, with a black spot on its base. Expanse, 0.7 inch; length, 0.3 inch.

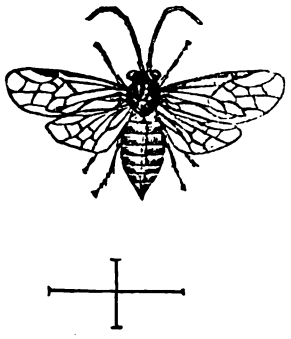

FIG. 21.—The poplar saw-fly, AULACOMERUS LUTESCENS, enlarged.

The insect is shown in Figure 21, enlarged to about two diameters.

Its Generic Reference.

The insect was submitted to Mr. E. T. Cresson for identification. It was unknown to him, and had not been described unless it had been given erroneous generic position, possibly with *Nematus*, to which it is closely allied, but differs therefrom by the second submarginal cell receiving both recurrent nervures. It was believed to belong to the genus *Aulacomerus* of Spinola (*Ann. Soc. Ent. France*, ix, 1840, 137), to which only a single North American species has hitherto been referred — *A. ebenus* Cresson, from Colorado, with larva unknown.

A Second Brood Observed.

A second brood of the insect was observed upon the same tree during the month of August. A large number of the foot-stalks of the leaves at this time bore the marks of egg-deposit, in two parallel rows on opposite sides, usually, of a rib on the upper side of the petiole. The rows had apparently been made the one after the other, as they were seldom of equal length, and each, for the most part, having the punctures in a perfectly straight line. The foliage of the tree was so badly eaten, that in order that it might continue to serve as an ornament, it was necessary to pluck off such of the leaves as could be conveniently reached that had been fed upon, of which only the ribs and a basal section remained. Another tree of the same species, which was daily passed by me in one of the streets of Albany, also showed the attack of this sawfly — first, in the eaten leaves, and on closer observation, the larvæ feeding thereon.

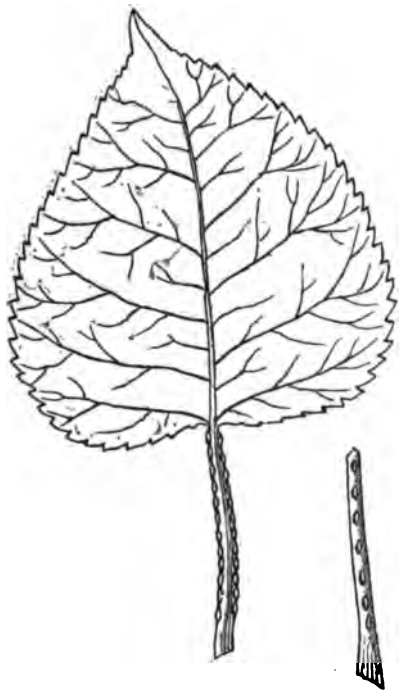

FIG. 22.— Poplar-leaf showing scars made in oviposition by AULACOMERUS LUTESCENS. In natural size and in enlargement.

Larvæ of this brood were gathered and fed, but they failed to secure proper care, and none of them, although a few spun up in cocoons, entered into their pupal stage.

Currant Bushes Girdled by an Unknown Insect.

The Attack an Extended one.

Tips of currant bushes, girdled by some insect, were discovered by Professor C. H. Peck, N. Y. State Botanist, in his garden, at Menands, near Albany, during the latter part of May. Examinations in gardens in Albany showed similarly affected tips, and indicated that the attack was somewhat general in this vicinity. In my own garden, a large black currant had many of the fresh, succulent tips girdled in the same manner. Nothing of the kind, so far as could be learned, had been observed before.

Features of the Attack.

The features of the girdling were these: A short distance below one of the larger leaves of a tip, five or six sharp, somewhat curved cuts could be seen, encircling the stalk, and from their depth, nearly severing it, causing the tip to fall over and hang suspended by only some small points of attachment. In some instances, where from the dried condition of the end of the stalk, it was probable that the cutting had been done a few days previously, the tip had broken off and fallen to the ground.

The Insect Unknown.

Effort was made by Professor Peck to discover the author of this new injury, but no insect upon which it could be chargeable was found. It was evidently done during the night, for after removing all the tips that had been cut in this manner late in the afternoon, freshly cut ones would be discovered on the following morning. Two or three species of *Lampyridæ* fell under his suspicion from being the only insects noticed on or about the bushes, but such an operation would be quite at variance with what is known of their habits; and furthermore, no manifestation of the kind was made by the specimens that were brought to me, and tied in gauze upon bushes in my garden.

Compared with the Raspberry-stem Girdling.

This attack is quite distinct from that of the raspberry-stem girdler, *Oberea bimaculata* Oliv., in which there is a double girdling, the one at about one inch from the other, with the egg inserted between the two, and the larva when hatched burrowing downward in the cane. In this there is but one cutting as has been described, nor does the larva burrow and mature within the stalk, for the most careful examination failed to give any indication of egg-deposit or larval presence therein. In all probability, the egg is placed just above the point of girdling. The tip, either from the continuity of the encircling cuts,

the action of winds or the vegetal changes that take place at the wounded part, soon falling to the ground, the young larva escapes therefrom and enters the earth. That the food for an insect of the size of one indicated by the cuts made by its mandibles could not be furnished by the excised and soon dried tip of less than a half-dozen inches in length, is evident. It is probable that its food-supply would be found among the roots of the plant.

The Young Insect Seen.

Of a large number of the tips which were dissected in the search for the insect, in a single one, only, was it discovered, as a minute, whitish, oval creature, apparently just from the egg, occupying place very near the point of excision. Its structural characters were too imperfectly developed to admit of its positive reference to any one of the orders, but it was believed to belong to the Hymenoptera. Other tips kept for several days in a moist condition, gave no further developments.

How the Attack may be Determined.

If its habits and food be such as above conjectured, there is but little chance of obtaining the insect by rearing it from the egg, unless with the aid of potted plants kept under observation within doors. A better method of ascertaining the author of this secret attack, would be, to detect it in its work, by seeking it with a lantern at night. Will those whose interest or curiosity may be awakened by the above account, bear in mind the character of the attack, and embrace any opportunity that may be offered in its recurrence to aid us in the effort to obtain the scientific name of the currant-stem girdler?

Orgyia leucostigma (*Sm.-Abb.*).

The White-marked Tussock-Moth.

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

Repetition of the Elm-twig Girdling.

The peculiar form of attack by the caterpillar of this moth, noticed in the *Second Report on the Insects of New York*, 1885, pp. 86–89, figs. 11–15, in which immense numbers of the tips of the elms in the city of Albany, during the summer of 1883, were girdled in the new growth and subsequently fell to the ground, was again

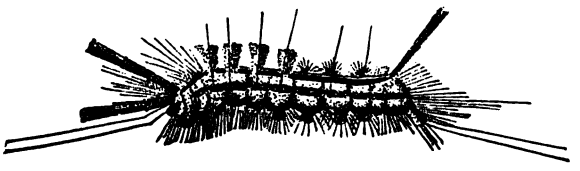

FIG. 23.—The Caterpillar of the White-marked Tussock-moth, ORGYIA LEUCOSTIGMA. (After Emmons.)

observed in Albany the present year, 1887, but to a much less extent than before. Early in June individual leaves of elm were picked up from the sidewalks, having their foot-stalk so peculiarly eaten to a point that it at once suggested the former demonstration above mentioned, which had not been observed in the intervening years. The suspicion was confirmed a few days later (June 10th) by the falling of girdled tips in every respect like those of 1883. The fall continued for some time thereafter — perhaps throughout the remainder of the month, but as it was not very abundant, and was only conspicuous in certain localities in the city — the most marked one being in the vicinity of St. Peter's Church, at the intersection of Maiden lane and Chapel street, — no particulars were noted of its extent or continuance. The caterpillar is represented in figure 23.

The Same Observed at Utica, N. Y.

In the first notice of this attack, above cited, it was stated that it had also been observed by me at Troy, N. Y., at the time that it was prevailing at Albany, but had not been reported elsewhere, although it probably extended to other localities where the Orgyia abounded under similar climatic conditions. My only knowledge of its occurrence at other places, is from a communication made to the *Utica Morning Herald*, by Mr. Daniel Batchelor, of that city, in June of 1887. The cutting from the paper is before me, but its date was not preserved. Mr. Batchelor states:

Yesterday, L. B. Root, of New Hartford [six miles west of Utica], informed me that the leaves of an elm tree on his lawn were falling off in showers sufficiently to cover the ground immediately under the tree. On riding into town, Mr. Root had observed an elm on the north-east corner of Genesee and Dakin streets, where the same green shower of leaves was fluttering down. The writer went to the tree, and there saw the fresh, green, glossy leaves fast falling and bestrewing the street about as thickly as do the faded leaves in autumn. The leaves are severed from the twigs about midway of the petioles or stems, a few only being cut off nearer to the axils. The severing is as clean as if done with a razor. Professor Lintner, the State Entomologist, first witnessed the same kind of defoliation of elms in Albany, early in June, about five years ago.

Must the Insect be Renamed?

It is possible that the above attack, together with all that I have hitherto published of the presence and operations of *O. leucostigma* in Albany, may have to be referred to another species. Mr. John B. Smith, of the National Museum at Washington, who is conceded to be excellent authority in the Lepidoptera, and has for a long time been a careful student of the order, having lately seen examples of the

moth so labeled in my collection and also taken examples with him for further study and for comparison, has since written to me in relation to them, and pronounced them to be *Orgyia definata* Packard (*Proc. Entomolog. Soc. Phil.*, iii, 1864, p. 332). The question of the correct determination of this very abundant species with us, deserves prompt attention, and I will therefore extract a portion of the letter received from him, as of special interest to Lepidopterists.

The *Orgyia*, as I expected, proves to be *O. definata* Packard. It is certainly a good species, distinct from *O. leucostigma*. The specimens of *leucostigma* in Meske's collection [made largely in the vicinity of Albany, and lately added to the National Museum], also turn out to be, on examination, *O. definata*. It is an interesting question, therefore, whether *O. leucostigma* really occurs near Albany. *O. definata* does not occur in or near New York city, and, so far as I am aware, none of the local collections have it. It occurs again in Maine, but it has probably been so generally confused with *O. leucostigma* that little is recorded of it. The latter I found on Cape Cod in great abundance. It will be a matter of interest, also, to find whether the larva differs. Thaxter has bred it and says that it does.

The following is Dr. Packard's description of *Orgyia definata*, from *loc. cit. sup.*:

Umber-brown; head, thorax, base and inner margin of primaries more testaceous [than in *O. leucostigma, cit. prec.*]. A faint, basal dark straight transverse line. Beyond and near the linear lunate discal spot, which is surrounded by the testaceous brown, is an indistinct nearly straight line. An outer very distinct curved line, being straight on the costa to where it is angulated on the fifth subcostal nervule, and again half-way between the discal spot and internal margin. Beyond this line on the costa is an oblong, dark, well-defined spot succeeded by a submarginal row of dots, ending in a white spot near the internal margin.

Beneath lighter, lines faintly seen beneath, the outer one extending faintly on to the secondaries, which have a discal dot.

The markings are much more distinct in this species than in *O. leucostigma*, while the outer line is angulated nearer the middle.

Length of body, ♀, 0.60; exp. wings, 1.20 inch.

Boston (Sanborn).

The question raised in the above should be satisfactorily decided by observations that can easily be made the coming season.

A Second Brood in New York.

The operations of the second brood of *O. leucostigma* were observed by me in New York city, on the fifteenth of August last. Nearly all of the larvæ had already disappeared, but some not yet full-grown were feeding or wandering about in search of food. Maples in various parts of the city had been badly eaten. A large horse-chestnut at the north-west corner of Second avenue and Twelfth

street, had only the principal ribs of the leaves left. The blackened remains, enveloped in the threads of the larvæ which had been spun in their dropping from the branches above, with grains of excrement clinging to them, gave to the tree a more repulsive appearance than any that I had ever seen as the result of insect attack.

Lagoa opercularis (Sm.-Abb.).

The Rabbit Moth.

(Ord. Lepidoptera: Fam. Bombycidæ).

Smith-Abbot: Nat. Hist. Lep. Ins. Geo., 1797, p. 107, pl. 54 (as *Phalæna*).
Morris: Synop. Lepidop. N. A., 1862, p. 257 (descr. of male, from Walker).
Packard: in Proc. Ent. Soc. Phil., iii, 1864, p. 334 (descr. of female).
Walsh: in Amer. Ent., ii, 1869, p. 29 (brief notice).
Harris: Entomolog. Corr., 1869, p. 365—is not *opercularis*, but *crispata*.
Riley: 5th Rept. Ins. Mo., 1873, p. 126 (in list of stinging larvæ); in Amer. Ent., iii, 1880, p. 51 (brief description).
Murtfeldt: in Canad. Ent., viii, 1876, pp. 201-2 (stinging powers).
Hubbard: Ins. Affect. Orange, 1885, pp. 140-1, figs. 57, 58, 59.

An unusually abundant occurrence on an apple tree, of the strange-looking larva of this species, shown in Figure 24, was reported by Mr. C. R. Moore, of Birdsnest, Va. Eighteen were counted on a small tree, which had been almost denuded of its leaves. Of examples sent on the nineteenth of August, two had spun their cocoons when received on the twenty-third.

Fig. 24.—Caterpillar of Lagoa opercularis.

Stinging Power of the Larva.

Mr. Moore gives the following as his experience with the insect: "I find that when the caterpillar crawls over the skin on the back of my hand, that it causes the place to smart considerably for three hours or more, and moisture to exude from the skin."

The irritating powers pertaining to the hairs of this caterpillar have long been known: under rough and incautious handling they may be far more severe than above stated. Miss Murtfeldt has related in the *Canadian Entomologist*, for November, 1876 (viii, 201-2), experiments made by her with one of the larvæ, which she permitted to strike one of her fingers. The slight prick felt was speedily followed by irritation, and later in the day with severe pain, inflammation and swelling of the finger. Soda, ammonia, arnica, camphor, and acids were successively resorted to, but none served to allay the burning pain — as intense as if the finger had been held against glowing coals. A night of sleepless suffering followed, and it was not until the next morning that the pain subsided.

Other Stinging Larvæ.

Experiments, similar to these, made by me upon two other stinging larvæ, viz.: *Hemileuca Maia* (Drury) and *Lagoa crispata* Packard, may be found recorded in the *Twenty-third Report on the State Cabinet of Natural History*, 1872, pp. 143, 144,* and *Twenty-fourth Report on the State Museum of N. H.*, p. 140-1.† The last reference is to a portion of a paper — "Transformations of Lagoa crispata" (pp. 138–145, *loc. cit.*)— based upon collections made at Center, N. Y., during a season of such a phenomenal abundance of the larvæ, on *Quercus vaccinium*, *Pteris aquilina* (common brake), and other plants, that at least a thousand examples, although feeding separately and scattered, could have been taken within an hour's time.

The Poisoning Attending the Sting.

Dr. George Dimmock, in an elaborate paper "On Some Glands which open Externally on Insects," contained in *Psyche*, for September, October, 1882 (iii, pp. 387–401), gives authority for the assertion that "the severe poisoning produced by the hairs of certain larvæ of the *Bombycidæ*, is caused by the secretion from a minute gland at the base of each hair. The secretion of these glands, which may be formic acid or a formate in solution, fills the hollow central portion of the hair, and when the sharp, often barbed, hairs are broken in the flesh of attacking animals, the broken parts carry with them the poisonous secretion." The writer attests to an instance in which one of these larvæ in being brushed away from the neck, inflicted so severe a sting upon a middle finger, that the distal joint, healing only after several months, remained somewhat stiffened and deformed at the time of writing — after a lapse of thirty-seven years.

The Moth.

The moth is shown in Figure 25. It has a very woolly, pale yellow body tinged with brown. The front wings are umber-brown at the base, fading to pale yellow outwardly. Their surface is marked with fine lines of silver-gray, and the front margins are nearly black. The legs are yellow with dusky feet. The wings of the male moth spread about one inch; those of the female, one inch and a-half. (Hubbard.)

FIG. 25.— LAGOA OPERCULARIS — female.

Of the two cocoons, made in August, by the larvæ received from Mr. Moore, one gave out a male moth on May 16th. The pupa had

* Or, *Entomological Contributions* [I], pp. 11. 12. † Or, *Ent. Contrib.*, II, pp. 36–7.

pressed open the lid, and working half its length out of the cocoon, the empty pupal case was held in this position after the escape of the moth.

Is a Southern Insect.

Lagoa opercularis is a Southern insect, but according to Mr. J. B. Smith, it is somewhere recorded as occurring within the State of New York. It has also occurred at Reading, Pa., which is but a small fraction of a degree south of the southern limits of New York. In its western range, it extends, at least, into Texas.

The Caterpillar.

Mr. H. G. Hubbard, an Assistant of the Division of Entomology at Washington, has included *Lagoa opercularis* in his Report on the *Insects Affecting the Orange* (the accompanying illustrations are from the Report), and has written of it as follows:

The caterpillars of this moth are covered with long, silky hair [see the figure], underneath which are concealed shorter, stiff hairs, exceedingly sharp at the points, and powerfully nettling when they penetrate the flesh. Upon some persons the invisible wounds made by these hairs produce swellings, and an amount of irritation equivalent to a sting; the larvæ are, in consequence, popularly supposed to be very poisonous. When young, the caterpillars are white and resemble a flock of cotton wool. They undergo six molts, at one of the last of which they become darker, the color varying in individuals, from red-brown to light clay-color. When full-grown, the larvæ present the singular appearance of a lock of hair possessing sluggish life, and a gliding, snail-like motion. Its peculiar appearance is well illustrated in the figure given.

Dr. Packard has pointed out an interesting feature in the larva of *Lagoa crispata*, which, in all probability, exists also in *L. opercularis*, viz.: it has seven pairs of abdominal or false legs, instead of the normal number of five pairs. They are located as follows:

The first abdominal segment is footless; the second bears rudimentary feet; segments 3–6 bear normal prop-legs; the seventh bears a pair of rudimentary legs; segments eight and nine are footless, while the tenth bears the fully-developed anal or fifth pair of genuine prop-legs.

While these two pairs of tubercles differ from the normal legs in being much smaller and without a crown of curved spines, they are protruded and actively engaged in locomotion: in situation, as well as in the presence of the basal tufts they are truly homologous with the normal abdominal legs. (*American Naturalist*, xix, 1885, pp. 714–715).

The Cocoon.

Its dull brown, felt-like cocoon represented in Figure 26, usually placed on a branch or in a crotch of a tree, has a protuberance on its back which almost exactly counterfeits a winter bud. It is provided with an accurately fitting hinged trap-door, which is skillfully built by the larva at the time of the construction of the cocoon, instead of being subsequently cut by its jaws, as are many of the lids of cocoons of the Lepidoptera, Hymenoptera, etc. For a detailed account of the peculiar structure of the lid in the cocoons of *Lagoa*, and evidences of design shown therein, the article on *Lagoa crispata* previously cited, may be referred to.

FIG. 26.—Cocoon of LAGOA OPERCULARIS.

Nephelodes violans Guenée.

The Bronze-colored Cut-worm.

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

[For Bibliography, see First Rept. on the Insects of New York, 1882, p. 99.]

Caterpillars of the above named species were received under date of March 30th, from Prof. D. P. Penhallow, of McGill University, at Montreal, which had been taken a few days previously from a large number traveling over the surface of the snow, and had therefore, from the unusual nature of such an appearance, excited no little curiosity. Not being able to recognize the species in its immature state, examples were sent to Washington for comparison with the alcoholic specimens in the National Museum, where they were identified as *Nephelodes violans*—the bronze-colored cut-worm, a notable demonstration of which in the pastures and meadows of St. Lawrence county, N. Y., in the spring of 1881, is narrated in my *First Report Ins. N. Y.* Figure 27 represents the caterpillar in its mature size.

FIG. 27.—Caterpillar of NEPHELODES VIOLANS.

Upon requesting from Prof. Penhallow that he would obtain all the particulars possible of so interesting an occurrence as the appearance of this caterpillar in winter, under the conditions named, in such a northern latitude, he kindly sent the following communication, from Mr. David Robertson, of Brockville, Ontario:

Occurrence of the Larvæ in Winter, in Canada.

The larvæ were first noticed on the afternoon of March 25. On the previous day we had had a sudden thaw, with high winds and very heavy rains during the evening, and before morning the temperature

had fallen to five degrees above zero. With the exception of rising somewhat with the sun, it continued at that temperature for several days.

The larvæ were found in a field six hundred feet in width, scattered over that distance for about three hundred feet in length, at an average distance apart of perhaps two feet; but in certain places, they lay in great quantities and all alive. The field was covered, as well as all of the surrounding country, with from one to two feet of snow and ice. There was no manure in the field.

On the following day I found that the greater part had disappeared, and the few that were left were dead, and a number of crows were busy in picking them up and eating them.

I did not look for them beyond the space named, and am unable therefore to say anything about the area over which they fell.

Description of the Winter Caterpillar.

One of the snow caterpillars received from Professor Penhallow was fed on spinach leaves to maturity. It pupated May 13, but failed to disclose the moth. The following notes were made of its appearance when full-grown:

Dorsum dull yellow, with numerous interrupted, crinkled, longitudinal lines — the two dorsal ones, defining the mesial stripe, continuous; two black dots on the anterior portion of each segment dorsally. Head small, less than one-half the breadth of the middle segments, brownish, with black reticulations, with two black lines over its front, dividing to border the △ — the latter pale; the four eyes black; hairs long. Abdomen with a subdorsal dark green stripe, paler at the sutures, bordered below with a narrower white one; a broader substigmatal stripe just above the spiracles, traversed medially with a paler line, and bordered by white; a pale green stripe between this and the subdorsal above; below this a stigmatal pale yellow stripe bearing the small oval black stigmata; ventral region watery-green; posterior end of body quite tapering. Legs and prolegs pale — the latter with a black band outwardly at their base. Length of larva, 1.25 inch; breadth at widest, 0.23 inch.

Its Midwinter Occurrence in Sullivan County, N. Y.

A similar appearance of this caterpillar in midwinter, had been brought to my notice two years previously through some newspaper accounts of "a shower of yellow worms," that had followed a snow storm at Liberty and at Stevensville, in Sullivan county, N. Y., on December 27, 1884. After communicating with several persons in search of some precise information of the phenomenon, I was so fortunate as to obtain what I desired from the gentleman who observed the occurrence, and who was able to give an intelligent account of it —

Mr. Isaac H. Soules, of Mongaup, Sullivan county, N. Y. — a teacher of a school at that place. From his letters I extract as follows:

On my way to school, early in the morning, upon leaving the main road to cross the fields, I saw in the snow, moving quite fast, numbers of worms of different sizes, from about one-eighth of an inch to one inch long. I stooped down and examined them, and found them to be of a yellowish color, darker on the sides than on the back, and lighter beneath. They were very lively, and traveled as fast as if on the ground. I called one of my neighbors and showed them to him, but had nothing with me in which I could carry any away. * * * When I took them in my hand they appeared to be very sensitive, and would curl up like this [giving a figure representing the curved position assumed by cut-worms when disturbed], and would remain so as long as held in the hand, but as soon as replaced in the snow, would crawl as lively as ever. The snow was about six inches deep, and falling at a very rapid rate, although it was quite cold — two degrees below zero. There was a hard crust underneath the falling snow. The worms were only on the surface, and seemed to be confused, crawling in every direction. They were in the road, fields and woods. I never saw anything to equal it, and my curiosity was aroused. * * * * * I observed them from about 7.30 to 8 A. M. How long they continued on the surface, I am unable to say, as I called school at 9 o'clock, and was not out again until noon, when I could not find any of them, much to my surprise and regret, as I had arranged to secure some of them. * * * * The local papers are making all sorts of sport about the worms. * * * * * They were not seen at Stevensville, as reported, but in the town of Bethel, Sullivan county, about two and a-half miles from the former place. * * * * * The smaller ones resembled cut-worms, such as we commonly find in our gardens. The larger ones were like those that are seen on timothy hay when ripe or nearly so [meaning, probably, *Leucania albilinea* Hübn.], except that they were of a brownish color and not striped on the sides.

Later, Mr. Soules informed me that the worms were seen at another place (not stated, but presumably in the town of Bethel) by some workmen on the canal. The snow was falling fast at the time, the temperature was below zero, and the worms were moving rapidly. Upon questioning the men closely, he concluded that they were of the same kind as seen by him, and their occurrence was at the same time.

Identification of the Caterpillar.

Two weeks thereafter, Mr. H. M. Stoddard, Postmaster at Stevensville, of whom I had requested information and specimens, sent me a number of "the worms found crawling on the ice at our place." They were submitted to Mr. Soules, who identified them as of the same kind as seen by him. They were also sent to Washington, to the Entomological Division, where, on comparison with the alcoholic specimens, they were pronounced *Nephelodes violans*.

The Mature Larva Described.

The following description of a nearly matured larva of *Nephelodes violans*, drawn by me from an example taken from beneath a stone, at Centre, N. Y., on June 13th, was overlooked in my preparation of the notice of the insect in the *First Report on the Insects of New York:*

Head brown, mouth rounded, broader than long, breadth 0.15 inch; mandibles blackish. Collar glossy black, traversed by three yellow lines, which are continued over the body as a dorsal and subdorsal sharply defined, pale, dull green stripes — the dorsal stripe slightly narrower than the others; the three, in their continuation over the caudal plate, become yellow-green. In addition to these — an obscure narrow lateral green line, and a substigmatal stripe which is broader than the other three, and terminates in the anal prolegs; the small black stigmata rest on the upper margin of this stripe. The body is of a glossy bronze-green color, with a slightly shagreened appearance above, and beneath paler green. The legs and prolegs are obscure green; the latter marked outwardly with a glossy black crescentic spot. When held up to the light in a plane with the eye, the body shows short whitish hairs at the setiferous points.

The larva fed on grass, and passed its final molting three days after its capture. It subsequently gave the moth, but the date of its emergence and of its pupation were not noted.

Homoptera lunata (Drury),

As a Rose Pest.

(Ord. Lepidoptera: Fam. Noctuidæ.)

Phalæna (Noctua) lunata Drury: Illus. Nat. Hist., i, 1770, pl. 20, fig. 3; (without name); Id. App., ii, 1773 (named).
Phalæna (Noctua) edusa Drury: Ill. Nat. Hist., App., ii, 1773, pl. 24, fig. 4.
Noctua lunata Westw.-Drury: Ill. Exot. Ent., i, 1837, p. 37, pl. 20, fig. 3.
Erebus edusa Westw.-Drury: Ill. Exot. Ent., ii, 1837, p. 46, pl. 24, fig. 4.
Homoptera lunata Guenée: Sp. Gen. Lep.—Noct., iii, 1852, p. 12.
H. *edusa* Guenée: Id. ib., p. 14.
H. *Saundersii* Bethune: in Proc. Ent. Soc. Phil., iv, 1865, p. 215.
H. *lunata* and *edusa*. Bean: in Canad. Ent., ix, 1877, p. 174.
H. " " Lintner: Ent. Contrib., iv, 1878, p. 108–9;
H. " " 30th Rept. N. Y. St. Mus. N. H., 1878, p. 220.
H. *lunata*. French: in Canad. Entomol., xiv, 1882, pp. 130–134.
H. *edusa*. Grote: Ch. List. N. A. Moths, 1882, p. 42, No. 1301.
H. *lunata*. Lintner: in Count. Gent., xlix, 1884, p. 737.

Occurrence in a Rose-house.

The beautiful moth bearing the above name has long been known as an ornament of entomological collections, while its larva has seldom come under observation, and consequently little has been written of its habits. The caterpillars have recently been discovered as operating injuriously in a rose-house in Madison, N. J. Their work had been conducted with secrecy, as during the day they rested quietly on the stakes to which the roses were tied, selecting such as resembled them in color so that they were scarcely observable; but at night they became active, and resorting to the plants, fed upon the buds, of which they consumed large numbers. The time of their greatest injury was from October to January. Moths reared from them, were sent for name, history, habits, etc.

Habits and Natural History.

The moths are a large and prettily marked species of the *Noctuidæ*, known as *Homoptera lunata* (Drury).

The habit of the caterpillar of hiding on the stakes to which rose bushes are tied, counterfeiting the color of the wood upon which it rests, and leaving its retreat at night to feed upon the buds, has not been previously recorded, and is quite interesting. It seems to feed upon quite a number of greatly differing food-plants, as upon plum, willow and maple, according to Prof. French, and on oak, as stated by Guenée. Abbot, according to Guenée, has figured it in association with a species of *Hypericum*.

The eggs laid by the parent moth hatch in five days. There are apparently two annual broods of moths. Eggs of the spring brood, deposited April thirtieth, gave the moth at intervals between June twenty-first and July tenth, the average period for the change into the perfect insect being sixty days. Of the autumnal brood, larvæ captured abroad on willow and other bushes, have formed their cocoons the last of September, and disclosed the moths early in November; or wintered as pupæ, and gave out the moth the following spring. The above items in the life-history of the insect are from a paper by Prof. French, narrating its preparatory stages, in the *Canadian Entomologist* for July, 1882, pp. 130–134.

The Caterpillar.

The caterpillars are described by Guenée as whitish, shaded with gray, with a blackish dorsal and subdorsal interrupted lines. Upon the incisure, between the fourth and fifth rings, is a large yellowish spot, and on the back of the fourth, two blackish circles, inclosing

each a small wart. There is a small yellowish spot on the sixth incisure. On the seventh ring is a large gray space. The first three rings have each a black mark on the side. The legs and head are of the color of the body; upon the latter are some black marks. The pupa is entirely covered with a violet-like efflorescence.

The above differs in several particulars from the more extended and carefully prepared description of the same stages by Prof. French.

A Marked Sexual Difference in the Moths.

The sexes of this species differ so much in their markings that they were described, above a century ago, as two species, viz., *Noctua lunata* and *Noctua edusa*, and were accepted as distinct until shown by me in 1878 (*Entomological Contributions*, No. IV, pp. 108–9) to be but sexual forms of the same species. All the "*edusa*" of our collections were found, on examination, to be males, and all the "*lunata*" females.

Not Usually Injurious.

It is distributed over a large portion of the United States, but has never been found to be very common or injurious anywhere. When occurring in rose-houses its injuries could be prevented by looking over the stakes during the few weeks that the larvæ appear, and collecting them by hand and crushing them. When occurring elsewhere they should be sought for during the day upon the stalks or trunks of the plants that they infest, or on other objects in the vicinity to which they would be attracted by a similarity of coloring with themselves, favorable to their concealment.

A Hemlock Leaf-Miner.

Some twigs of hemlock, *Tsuga Canadensis*, communicated by Prof. A. N. Prentiss, of Cornell University, during the month of January, were found to have a number of their leaves mined by a minute larva, which was evidently a lepidopterous insect, and probably belonging to the *Tineidæ*, judging from a head-case discovered among the threads that bound together some of the mined leaves. No larva is known to attack the hemlock in this manner, and it is not improbable that the insect is new to science.

There is a possibility, however, that it may be the *Gelechia abietisella*, which Dr. Packard has described and figured in the *Report of the Commissioner of Agriculture* for 1883 (pp. 150–151, pl. 3, f. 2, pl. 13, figs, 7, 7a, 7b), as having been observed in the spring of 1883 in the vicinity of Providence, R. I., causing sere and dead patches of

leaves on the smaller branches and twigs of hemlocks, both large and small. The operations of the Gelechia caterpillar had consisted in biting off from six to eight leaves of which to construct a broad, flat, irregular case, within which it lived in a rude silken tube, and fed upon the inside of the leaves.

No larvæ were found within the mines, but from the fact that several leaves were observed to be fastened together and separated from the twig, it is possible that at the approach of winter they may have abandoned their mines to hibernate, as Dr. Packard suggests that *G. abietisella* may do, within a silken tube inside of the leaf-case.

Professor Prentiss states that the injury to the hemlocks was first noticed at Ithaca, at about the first of December, since which time it had apparently increased, or at least become more conspicuous. Hundreds of trees in Cascadilla ravine, near the college grounds, were thus affected.

Cecidomyia balsamicola n. sp.,

AND ITS GALL.

(Ord. DIPTERA: Fam. CECIDOMYIDÆ.)

For the past two years galls occurring in abundance in some localities, within the leaves of the balsam fir, have been in my possession and under observation, in the hope of obtaining the perfect insect from them for description. Late observations have shown that there is no prospect of securing the imago very soon — certainly not before the lapse of another year — as carrying the larva to its final stage promises to be both difficult and uncertain. In the belief that publication of what is known of the insect and its operations will serve to draw attention to it and aid in the early completion of its life-history, it is herewith given a scientific name, some of the more prominent features of the larva are mentioned, and its gall is described.

The Gall only Known on the Balsam Fir.

The galls have been observed by me only on the balsam firs, *Abies balsamea*, of the Adirondack mountains, but they will probably prove to be of somewhat wide distribution, for in the collection of the Museum of Comparative Zoölogy at Cambridge, Mass., is a balsam tip bearing the same gall, which Dr. Hagen informs me was obtained at Shelbourne, N. H., in September 1882, by Professor Farlow. I have not been able to find them on balsam firs in the vicinity of Albany, nor on any other species of *Abies* examined by me other than *balsamea*.

Its Abundance at Lake Pleasant, N. Y.

During July and August last they were observed in large numbers at Sageville (Lake Pleasant), Hamilton county, N. Y. To many of the trees they imparted a peculiar nodose appearance, in instances where they abounded to such an extent that at least three-fourths of the leaves of the tips of the season's growth bore the gall. At this time each contained its larva, which but partially filled the gall, yet appearing as if it had nearly attained its growth. The larvæ, when exposed to examination, were inactive, hardly showing any motion, and giving no evidence of a disposition to feed.

The Gall Described.

The gall consists of an oval enlargement of the leaf near its base, varying in position from entirely basal (rarely) to one-fifth of an inch removed (also rarely); the average distance does not exceed 0.05 of an inch. The average length of the gall may be somewhat above one-eighth of an inch, with a diameter two-thirds as great, which seldom exceeds twice the width of the leaf. Its elevation above the surface of the leaf is about equal on the two sides, although sometimes seeming more depressed superiorly from the bending of the leaf by its deformation forming a concavity above. The exterior of the gall is smooth, except as showing some trifling irregularities of growth.

Fig. 28. — Balsam tip with galls of Cecidomyia balsamicola: *a*, leaf enlarged with gall seen on upper side; *b*, the same with gall from lower side, with opening for escape of the larva; *c*, leaf from which the larva has escaped through opening on upper side.

The Larvæ Elude Efforts to Rear them.

Examples of the galls collected at Lake Pleasant were inclosed in tin boxes, glass jars, and bottles, and occasionally sprinkled with water, as the transformations of many of the *Cecidomyidæ* are known to be quite dependent upon moisture. Examinations of the contained larvæ at intervals during September and October showed them apparently unaltered in condition. Later, they were found hardened and dead.

Efforts made by myself and by the secretary of the New York State Forest Commission, Mr. A. L. Train, to obtain, from parties applied to, fresh galls during the autumn, were unsuccessful, and it was not until the last week in December that fresh material was procured, through the kindness of Mr. S. D. Andrews, of the Lake Pleasant House, at Sageville. The insects at this time had emerged. In only one gall was a larva discovered, which seemed to have recently died, and from which the following notes were drawn:

The Larva Described.

Color, reddish-yellow; surface delicately pitted under a high magnifying power, like fine shagreen; eleven segments deeply incised, the terminal twelfth showing indistinctly as a narrow appendage to the eleventh; laterally on each segment a very short black bristle visible under a three-fourth-inch objective; no other process apparent, even stigmatal ones. The stalk of the "breast-bone" is gradually widened toward its V-shaped anterior portion, of which the space between the arms is about equal to the width of one of the arms toward their junction where they widen exteriorly into a U-like character. Length of the larva, 1.20 mm.; breadth, 0.70 mm.

The Larva leaves the Gall for its Pupation.

The insect had left the gall through a longitudinal opening of more than one-half its length, which subsequently closed, leaving a border somewhat elevated, like lips. The opening, in the larger number of instances, is on the upper surface of the leaf — in thirty-four leaves out of fifty examined: in such cases, it is linear and usually in exact line with the midvein. When occurring on the under side, it is lateral on the gall, and only to be seen by turning the leaf sideways. The midrib of the lower surface is not continued over the gall. Upon cutting into the galls they disclosed a corky structure, and the interior surface of some displayed a transverse thready appearance.

From the above observations it seems probable that the larvæ of *C. balsamicola* mature in the late autumn, when they escape from the galls, and fall to the ground, either to enter the earth for pupation, or find

suitable place for change among the thick bedding of leaves beneath the trees. Here they would hibernate, perhaps as larvæ, to pupate in the early spring, and disclose the perfect insect at about the time when the new leaves are developing.

The Galls Occasion Partial Defoliation.

It will be of interest to learn to what extent the occurrence of this gall tends to the defoliation and consequent injury of the trees which it infests. From the examples of the foliage received by me, it is seen that leaves bearing the galls were still attached to the tree at the close of the year, but were so loosely attached that a slight pressure removed them. Many had broken off in transit, and were loose in the package when received. The twigs showed the scars of detached leaves to at least double the number of the galls inclosed, indicating a considerable fall of the infested leaves, under natural conditions, during the month of December. Later, all the galls fall from the tree.

The Insect not Known in Europe.

The insect appears to be a native species. Baron Osten Sacken, who has seen the gall, after searching the European literature of the *Cecidomyidæ* states that there is nothing analogous to it in Europe. Dr. F. Loew, of Vienna, concurs in the above, and remarks incidentally that the gall belongs to a group which have their habitat in the parenchyma of the leaf (Blatt parenchymgallen), occurring on *Quercus*, *Ulmus*, *Tilia*, *Centaurea*, *Hieracium*, etc.

Lasioptera vitis O. S.

(Ord. Diptera : Fam. Cecidomyidæ.)

Osten Sacken: Monog. Dipt. N. A., Pt. i, 1862, p. 201-2; Cat. Dipt. N. A., 1878, p. 6.
Walsh-Riley: in Amer. Entomol., i, 1869, p. 247, fig. 183.
Riley: 5th Rept. Ins. Mo., 1873, p. 117-8, fig. 45.
Reed: in 13th Rept. Ent. Soc. Ont., for 1883, p. 49, fig. 33.
Saunders: Ins. Inj. Fruits, 1883, p. 295, fig. 306.
Lintner: in Count. Gent., xliv, 1879, p. 407; id., liii, 1888, p. 511.

Lasioptera vitis — a minute dipterous insect, belongs to the group of gall-making *Cecidomyidæ*. The genus *Lasioptera* is readily distinguished from *Cecidomyia*, to which it is quite near, by its nervulation, for while the latter, with few exceptions, has four longitudinal veins, this has but three, and of these the first and second run so close to the costal margin as to be almost undistinguishable. Its third vein, the only conspicuous one in the wing, is forked much as in *Cecidomyia* and *Diplosis*.

Description of the Galls.

The tip of a seedling grape and some separate leaves were received on the seventh of June, from Mr. Henry Lee, of Middlehope, Orange county, N. Y., upon which were numerous galls of *Lasioptera vitis*. The tip, for about five inches of its extent, was covered by the abnormal growth upon it, and so distorted that it was bent downward until its natural direction was completely reversed. The older galls were bright red, the younger ones still green. They were frequently confluent — three or four having united to form one elongated, irregular swelling. Figure 29, represents a vine infested in this manner.

FIG. 29.—Galls of LASIOPTERA VITIS, on grape-vine; *a*, section of a compound gall, showing the larval cells.

The leaf-galls are of a smaller size than those of the tip, averaging two-tenths of an inch in diameter. They, in most cases, rest on the veins, but a few only touch them on one side; rarely, they are entirely disconnected. Their upper side is red (on the upper side of the leaf), while the obverse, withdrawn from sunlight, is green. Those containing a single cell, are round, with more than one-half of the gall showing on the under side of the leaf, and with its connecting vein bent downward on its surface. The larger number are single-celled — the result of a single oviposition. The confluent ones, or even the elongated, occurring on the vine more frequently than on the leaf, of course contain two or more cells, as shown in section, in the figure at *a*.

On a part of a leaf within an area of an inch and a half in diameter, thirty galls were counted.

Escape of the Larvæ.

Most of the galls had given out their larvæ when received; a number had emerged en route, and were found within the box: they were given ground in which they speedily buried. Others continued to escape from the galls for the two following days. Perhaps from thirty to fifty larvæ were transferred to the small box of ground and seen to enter therein. No note was made of their appearance, but it is remembered that they were of an orange-yellow color.

The larvæ emerge, indifferently it seems, from either the upper or the lower side of the gall, depending, probably, on the position of the leaf, as in one, nearly all have escaped from the upper side, and in another, the reverse. The opening through which the larva escapes is quite small; a pale ring surrounding it on the surface of the gall, looks as if the margin had been eaten away for its outer enlargement.

On the twenty-seventh of June, other specimens of the same gall were received from Dr. M. G. Planck, of Schenectady, N. Y., taken from wild grapevines. These were also disclosing their larvæ at the time when they were received. (*Query*, suggested by the inability to rear the larvæ: does the picking off of the vine have such an effect upon the sap as to cause the larvæ to desert the galls at once, even before they have fully matured? The apparent eagerness with which the closely related larva of the clover-seed midge, *Cecidomyia leguminicola* creeps from the clover head very soon after it is plucked, is recalled in this connection.)

The Only Known Remedy.

There is no known method by which the oviposition of this little midge can be prevented. The attack can best be met by plucking the infested tips and leaves before the larvæ leave the galls, and burning or otherwise destroying them.

The Larvæ Attacked by a Parasite.

In the month of July several chalcid parasites were found within the box containing the galls, and a single example of the gall-fly—all dead. Whether they were given out from the galls or from ground where the larvæ buried, is not known, as both were under the same cover. As the time for the appearance of the gall-fly seems to be in June (Osten Sacken obtained it on the 29th of June) and perhaps in early July, there is no prospect of obtaining further examples of the flies. It would seem as if the larvæ had died from immaturity or had been very generally parasitized. The chalcid obtained has

been determined by Mr. Howard as an undescribed species of *Tridymus* Ratz.— a genus very near, in place, to the *Pteromalinæ*, and not previously recognized in this country.

First Notice of the Insect.

Our first knowledge of this gall and its author is found in Baron Osten Sacken's admirable paper "On the North American Cecidomyidæ," forming part of the late Dr. Loew's *Monographs of the Diptera of North America*—Part I, 1862. The gall is thus characterized: "Swelling of the stem and leaf-stalks of the wild grape. This irregular succulent swelling, which becomes red on its stouter and riper portions, extends not only along the stem and leaf-stalks, but also invades the leaf-ribs. It contains round hollows of about 0.1 in. in diameter with an orange-yellow larva in each. Some of the hollows are often abandoned by their inmates and invaded by numerous *Thrips*."

The fly has not been figured; its description is as follows:

Description of the Fly.

L. vitis O. S.—0.04 in. long, pale reddish, head blackish, antennæ black, apparently 23-jointed, filiform, joints broader than long, sessile, with a short pubescence (they answer exactly Winnertz's figure of the antennæ of *L. rubi* Wz.), two basal joints yellow, thorax blackish above, with a golden pubescence near the collar and down to the origin of the wings; scutellum pale reddish; abdomen covered superiorly on each segment with rows of blackish scales; legs pale reddish, wings with gray pubescence, anterior margin with a black fringe of hairs (*loc. cit.*, page 202).

Various Forms of the Galls.

The figure given on page 64 shows one of the many remarkable forms which this gall assumes. It is from Prof. Riley's 5th Missouri Report, where he has named it "the grapevine tomato gall," and remarks of it that it is a "most variable gall, being found of all sorts of fantastic shapes, from the single, round, cranberry-like swelling on a tendril, to the large collection of irregular bulbous swellings on the stem or leaf-stalk; sometimes looking not unlike a bunch of currants or a bunch of grapes, but more often like a collection of diminutive tomatoes." From a brief notice accompanying an earlier presentation of the same figure — in the *American Entomologist* for August, 1869 (page 247), it appears that the specimens identified from Ridgewood, N. J., were irregular, compound swellings on the stems and leaves, each swelling being of about the size of a large pea. Such forms certainly could not be suggestive of small tomatoes, nor those illustrated in the figure, nor any that have come under my observation. The common name proposed above for the gall would, therefore, seem to be an inappropriate one.

Localities of its Occurrence.

The editors of the American Entomologist have identified the galls from Des Moines, Iowa. The Osten Sacken catalogue of N. A. Diptera gives its habitat as "District of Columbia and elsewhere." In former years I have received it from Staatsburg, N. Y., and from New Jersey, where it occurred on the Concord grapevine. It has also been received by me from Orange county, N. Y., on a Muscadine vine; from Worcester, Mass., on a "Rogers 15" seedling; and from Schenectady, N. Y., as before stated, on a wild grapevine.

Chloropisca prolifica Osten Sacken, n. sp.,

And Its Winter Gatherings in Dwellings.

(Ord. Diptera: Fam. Oscinidæ.)

The immense numbers in which various insects, which are not recognized as social in their nature, are observed to congregate at certain times, and under certain conditions, is a phenomenon full of interest, and one for which no satisfactory explanation has been offered. Without citing an extended list of such assemblies, a few of those in which species of *Chlorops*, belonging to the family of *Oscinidæ*, have been drawn together for hibernation will be mentioned, in connection with two recent instances of the kind brought to my notice.

A Remarkable Assemblage of Flies at Franklin, N. H.

In March last, examples of a small fly were received from Mr. W. F. Daniels, of Franklin, N. H., with the statement that they were infesting his residence in such number that it was impossible to rid the house of their presence. They had become a great nuisance. Through several letters received in relation to them, the following account has been compiled:

The fly had been observed as early as the last week in August, in quite an active state about crevices in the wood-work and the windows of the second floor, where it was seeking entrance.

Later in the season a favorite gathering place for them was found to be in the space between the window sashes and the casings. Here they appeared to rest in stupid condition, but if the attempt was made to capture them, they flew briskly away. When the gas was lighted they flitted around the room in great numbers, and alighted on the ceiling and walls. They were not distributed generally over the house, but were almost confined to the north side — the front of the house — and to the second story. None were seen on the third floor, and comparatively few on the first. In a closed room thousands could be

killed by the use of pyrethrum, but without seeming to diminish their number in the least. They collected at times upon the windows so numerously as to soil the panes greatly.

Their Spring Awakening.

Their principal annoyance to the family seems to have been in the spring when they were awakening from their hibernation. Many that had doubtless been excluded from the house by the screens that covered the windows, had found acceptable retreats in crevices between the brick wall of the building and a substantial wooden covered porch erected over the front door. On April fourth of the present year, large numbers of the fly were observed at each side of the porch, moving sluggishly over the ice and snow which lay there at a depth of two feet. So abundant were they that kerosene was poured over them where they were the thickest, and very many were thus killed. At the same time they could be seen climbing up the front wall of the house, even to the roof.

Efforts for their Destruction.

On April twelfth, upon the discovery that multitudes were emerging from the crevices between the porch and wall, insect powder was blown in upon them with a powder-bellows, and in an hour's time, as reported, "millions were scattered over the stone steps. They were taken up three or four times that day, and again on the eighteenth, twentieth and twenty-second, and dropped quickly into boiling water, for if left awhile they revived. Since that time they gradually disappeared," and on May third, the date of a letter received, none were to be seen. So many had been killed by the persistent means taken for their destruction that it is thought that they must have been nearly exterminated, and hopes are entertained that another autumnal visit may not be received from them.

Annual visitations of the same fly had occurred for at least five or six years past. They had not been noticed in any other dwelling in the vicinity. This house was quite alone from any other.

Conjecture as to their Source.

In reply to the inquiry made of me of the probable source of these flies, answer was returned that several of the *Oscinidæ* are known to breed in the stems and roots of the *Gramineæ* (grass family), and that the breeding-places of the Franklin chlorops might, perhaps, be discovered in some of the neighboring grain fields, if they gave evidence of being infested. To this, reply was made that within many miles of the place, very little grain was grown and there was none that had been infested

with insect pests to any material extent. The house was surrounded with a broad lawn, and in front was fine, green grass for two hundred feet or more. Across the road was a hill rising to a height, perhaps, of a hundred feet, extending for an eighth of a mile, and covered with a growth of oak, pine, and locust trees.

As the source of such "mass meetings" of Chlorops is unknown and a matter of much interest, we quote some remarks made by Schiner, in a paper entitled "Ueber massenhaftes Auftreten einer Chlorops Art, Verh. Zool. Bot. Ges. Wien, 1872, pp. 61–73," based on specimens received by the distinguished Dipterist, which had occurred in enormous numbers in a villa near Fiume on the Adriatic. These were referred to the genus *Chloropisca* — the same to which the Franklin examples belong: in the presence of half a dozen descriptions equally fitting and equally uncertain, they were given a new specific name, namely, *Chloropisca copiosa*.

The aim of these mass meetings of flies, I do not know, and do not want to add a new hypothesis to those already offered. * * * The known habits of several species of Chlorops make it probable that the larva of the present one must be looked for in stems and roots of *Gramineæ;* but our cereals seem to be out of the question, as there have never been any complaints about the depredations of a species like this; and owing to the immense numbers of the fly such complaints would certainly have been forthcoming if this species attacked cereals, like the larvæ of some other larger species of *Chlorops*. Those who happen to come across assemblages of this kind may find an opportunity for searching the *Gramineæ* in the environs, the more so as these assemblages are only local phenomena, but apt to occur in the same locality for several years in succession. With some patience, the flies themselves might, perhaps, be used as guides towards their breeding-places: by dint of watching their motions and following their flight, the truth might be learned.

Another Assemblage of the Fly in Western New York.

A second instance of an assemblage of this fly — found to be identical with the Franklin examples — was brought to my notice as occurring at Alfred Centre, Allegany county, N. Y., a village in the western part of the State. Dr. H. C. Coon, connected with the Alfred University, communicated several specimens which he had taken within his house, from the wall paper and a window, on the 18th of September. Others were seen on the outside of the window. On October 3d, "upon drawing down a sash of a window opening on a covered porch at the north end of the house, the casings at the sides and top were so covered with the flies that they could be scraped off by handfuls." They were not found about other windows, or in similar localities in neighboring houses where search was made for

their presence. It was recalled that they had been observed the preceding autumn in numbers sufficient to cause them to be swept together and burned.

In this instance, the invasion does not rank with the first recorded, but it may develop an increase in following years.

The Fly Submitted to Baron Osten Sacken.

As the fly was apparently unknown to us, it was submitted to Baron Osten Sacken, of Germany, for determination, and by him was referred to the genus *Chlorops*, subgenus *Chloropisca*. It was found to have some points in common with *C. copiosa* of Schiner, previously mentioned, but was different from it. As the species belonging to this subgenus vary greatly in color, even more than the true Chlorops, and are therefore quite difficult to identify from description however carefully made, I requested of Baron Osten Sacken that he would describe the examples placed in his hands, for publication in the present report. The task was no light one, as may be seen from the following description which he has most obligingly sent in compliance with the request:

Description of the Fly.

CHLOROPISCA PROLIFICA *n. sp.* [Osten Sacken.]

The breadth of the cheek under the eye is about equal to the distance between the eye and the antenna; the front is but little projecting in the profile, the face distinctly retreating. Front reddish-brown, shining, with a narrow yellowish border along the edge of the occiput and the frontal orbits; a more or less distinct brown stripe in the middle of the front, attenuate anteriorly and including the ocelli posteriorly; two shorter and often less distinct lateral stripes; frontal triangle large, nearly reaching the anterior edge of the front, its anterior angle rather broad (not acute as in some species of *Chlorops*), bounded on each side by shallow furrows (in some specimens, however, they are deeper); near the occipital edge the bottom of these furrows shows a couple of short, deeply-cut striæ; the surface of the front is marked with scattered punctures (sometimes nearly smooth; in front of the ocelli, in most specimens, there is a shallow impression (coinciding with the intermediate brown frontal stripe). Face and cheeks brownish-yellow. Occiput black or brown, yellow along the orbits. Palpi reddish-yellow; above them, a pair of black dots on the oral edge; when the proboscis is withdrawn these dots may be easily mistaken for the end of the palpi. Antennæ reddish-brown; third joint rounded, darker brown on its distal half, sometimes altogether brown. Thorax brownish-yellow, with the usual three black stripes and a shorter and narrower dark streak above the supra-alar cavity; the intermediate stripe is cut off squarely some distance before the scutellum, the lateral ones are elongate-wedge-shaped, their pointed end nearly, but not quite, reaching the scutellum; a faint longitudinal groove along each side of the intermediate stripe; on the sternum a large black triangular spot between the front and mid-

dle coxæ, on each side; a similar spot, but much smaller, above the hind coxæ; smaller black or brown spots on the lower part of the mesopleura and on the pteropleura, near the mesopleural suture.* Scutellum flat, brownish in the middle, yellowish towards the sides and tip; surface smooth; it requires a strong lens to discover a sparse microscopic pubescence, issuing from equally microscopic punctures; a pair of somewhat larger, approximate bristlelets at the tip. Halteres with a conspicuously yellowish-white knob. Metanotum black. Abdomen dark brown above; hind corners of the segments, and especially of the second, yellowish; hind margins of the segments, and especially of the penultimate, paler; these paler regions are variable in extent, and sometimes the upper side of the abdomen is almost altogether brown; the distal half (or less) of the last segment, is always yellow. On the ventral side, the extent of the brown and pale-yellowish is equally variable. Legs reddish-yellow, more or less distinctly brownish in the middle of the femora and tibiæ, especially of the last pair. Wings hyaline, veins brownish-yellow; anterior crossvein nearly opposite the tip of the auxiliary vein; the distance between it and the posterior crossvein is equal to about double the length of the latter; third vein, beyond the crossvein, nearly straight, parallel to the second; fourth and fifth veins very thin, except a very short distance beyond the great crossvein; the course of the fourth vein is a little diverging from the third; the costal vein reaches the tip of third.[†] Length 2-3 millim. I have about 30 unpinned specimens before me; they seem to be all females.

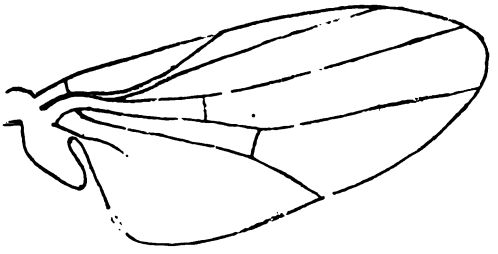

FIG. 30.—Wing of CHLOROPISCA PROLIFICA showing nervulation—greatly enlarged.

N. B.—It is at the special request of Mr. J. A. Lintner that I venture to describe this species, which belongs to a family I am very little acquainted with. Descriptions of Chloropisca are difficult to draw on account of the sameness of the coloring of the species and of the inconstancy of the same coloring. And in the present case I have not been able to use chætotactic characters, the specimens being unpinned and most of the bristles having fallen off. One of the principal characters is the flatness of the scutellum, which proves this species to be a *Chloropisca;* the proportions of the venation may likewise be of use in identifying the species. Two other *Chloropiscæ* have been described by Loew from N. America: *C. grata* Loew, Centur. III, 92 and *C. trivialis* ibid, III, 87. I can not identify my specimens with either of them.

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*I use the terminology adopted by me in my paper on Chætotaxy, *Trans. Ent. Soc. London*, 1884, p. 503.

[† Although drawn by camera, the engraving fails to show some of these features.]

Noted Assemblages of Chlorops in Europe.

The following literature upon the great accumulation of specimens of Chlorops within buildings — a phenomenon well-known in Europe — has been kindly collected, and communicated to me in letter by Baron Osten Sacken — always so ready to aid in the advancement of American Dipterology:

In September, 1831, an immense number of *Chlorops* gathered in a room in Provost's Lodge, in Cambridge, England. An account by Rev. L. Jenyns was published in *Loudon's Magazine of Natural History*, v, p. 302. The same phenomenon was observed in the same place in September, 1870, when "there must have been millions of them." It is added, however, that they occur regularly every season. (Compare *Proc. Ent. Soc. London*, 1870, p. xxxiv, and 1871, p. —.)

In 1833, the phenomenon took place in the court library in Weimar. Zenker took the fly for a new species, and named it *Traumatomyia prodigiosa*. (*Frorieps Notizen*, xxxv, p. 344.)

In September, 1847, Professor Wager found millions of *Chlorops* in the cupola of the observatory at Warsaw, on the ceiling of a botanical conservatory, and in other places. He computed that there were about 17,971,200 specimens on the ceiling of the conservatory. He observed these accumulations every year. All these localities are surrounded by fields of cereals, and principally wheat. Compare *Rev. de Zoöl.*, 1872, and Schiner's article quoted.

Kiesenwetter, in Zittau, Saxony (*Berl. Ent. Zeit.*, 1857, p. 172); Krauss, in Stuttgart (comp. Brauer, *Jahresber*, 1867, p. 142); Perty, in Switzerland (ibid.); H. Müller, in Lippstadt, in autumn of 1880 (comp. Katter's *Entom. Nachr.*, 1881, p. 17); Guerin Méneville and Laboulbene, in France (*Ann. Soc. Ent. Fr.*, 1875, p. ccvi), made similar observations. Most of them took place in September. Perty saw the phenomenon in March. Most of the observers notice the fancy of the flies for particular rooms, neglecting adjoining localities situated in apparently similar conditions. That the object of the flies was to seek shelter from cold is probable. The following observation by Aubé, although it does not refer to human dwellings, may be suggestive: "About the end of March last, after a not very cold but a prolonged winter, I collected thousands of *Chlorops nasuta* in the state of hibernation. They were huddled together behind a very dense covering of ivy, on the eastern wall of a building" (*Ann. Soc. Ent. Fr.*, 1858, p. lxxiv).

Whether in all the above cases the same species was observed is a very doubtful question. The species is called *Chlorops læta* (Wager, Krauss, Laboulbene), *C. nasuta* (Kiesenwetter, Aubé, H. Müller), and *C. lineata* (Perty). These identifications have no value whatever, as none of them were made by competent persons, and the nomenclature and synonymy of *Chlorops* is an unsolved problem even for dipterologists.

Phytomyza lateralis (Fallen).

The Marguerite Fly.

(Ord. Diptera: Fam. Phytomyzidæ.)

Fallen: Dipt. Suec., iii, 1823, 3, 2.*
Meigen: Syst. Beschr. bek. europ. zweifl. Ins., vi, 1836? p. 190.
Westwood: Introduc. Classif. Ins., i, 1839, p. 152; id., ii, 1840, p. 573.
Curtis: British Entomology,—Diptera, viii, 1849, pl. 393.
Kaltenbach: Pflanzenfeinde Classe Insekten, 1874, p. 387.
Glover: MS. Notes Journ.—Diptera, 1874, p. 40 (mention).
Goureau: in Ann. Soc. Ent. France, ii, ix, p. 156.
Falconer: in Amer. Florist, ii, 1887, p. 297 (as *P affinis*).

Its First Observation in this Country.

The operations of this insect, an European species, were first detected in this country in October, 1886, in the greenhouse of Mr. Charles A. Dana, at his country residence, Dosoris, near Glen Cove, N. Y. The leaves of some daisies (Marguerites) were seen to show some wart-like specks and irregular, whitish, linear markings, and soon afterward to shrivel up and die. Examination for the cause disclosed small "worms" working within channels in the interior of the leaves.

Some of the infested foliage was sent to Albany on the fifteenth day of February last. When received (two days later) the insect had entered upon its pupal stage, and a single fly had been disclosed and was found within the box. Another fly appeared the following day, and quite a number emerged from time to time until the tenth of March.

Operations of the Marguerite Fly.

In response to request made by me for further information of the attack, it was learned that the operations of the insect had been first noticed by Mr. Wm. Falconer, head gardener at Dosoris, during the preceding autumn, as above stated, and that thus far it seemed to be confined to plants of the Order of *Compositæ*. As it apparently displayed a preference for the daisy, *Chrysanthemum frutescens*, it had been given in the greenhouse the name of the Marguerite fly. Infested leaves of tansy (*Tanacetum*) and of three other species of the *Compositæ* (not identified), each bearing the pupæ, were sent to me. In each of the plants the mining operations of the larvæ had been exten-

* The following references to other European authors have kindly been given me by Dr. S. W. Williston:

Zetterstedt: Dipt. Scand., vii, p. 2836, 24.—Rob. Desvoidy: in Ann. Soc. Ent. Fr., 2d ser., ix, p. 156.—Schiner: Faun. Austr., ii, p. 313.—Brauer: Denkschr. k. Akad. Wissensch. xlvii, p. 90.

sive, and had caused the leaves to wilt and shrivel to such a degree that it was only by careful unfolding, spreading and pressing that the character of the mines could be made out.

The Larval Mines Described.

The mines observed in the daisy were run with remarkable uniformity, commencing at a point where there was indication of egg-deposit, at the margin of the foot-stalk of the leaf or at one of the lower lobes, following closely the margin up the lobe, excavating it somewhat broadly at the apex, then descending on the opposite side, to turn and mine the next higher lobe and following ones in the same manner. A characteristic feature of the mine is its punctulation along its entire length by small black grains of larval excrement, deposited at rather regular intervals, and almost invariably on the marginal side. An exception to this was an instance where a wavy broad channel had been run toward the center of the leaf, in which the excremental matter was not granular nor deposited marginally, but was diffused throughout the mine — indicating plainly some abnormal condition of the larva.

FIG. 31. A daisy leaf showing the mines and pupæ of the Marguerite fly, PHYTOMYZA LATERALIS.

The mines do not always originate in the lobes. One was observed to commence half-way down the stem of a leaf, and in another instance almost at the base of the stem. They are run upon the upper side of the leaves, just beneath the upper cuticle.

Pupation within the Mines.

When the larva has attained its growth, it excavates a blotch-like space on the lower side of the leaf, where it transforms to a pupa, which, covered only by the thin and transparent cuticle that in drying contracts over and closely about it, seems as if it were lying exposed upon the outer surface. Its deeply incised segments show distinctly, and its two subcylindrical contiguous anal spiracles — projected

almost at a right angle one with the other, are thrust outward through the cuticle in its contraction.

It is believed that all of the pupa observed in the month of February, were in the position above stated. In several of those received by me the present November, and now before me, they are plainly to be seen occupying the upper surface of the leaf. Can this be accidental or is it a seasonal feature?

Mr. Falconer's Account of the Insect.

Mr. Falconer has contributed to the *American Florist*, for March 15, 1887, ii, p. 297, a short notice of "The Marguerite Fly, *Phytomyza affinis*" (the scientific name taken by him from some European journal), giving items of its habits and life-history, which we copy:

The fly is a small insect and might readily be mistaken for one of the little flies so abundant about fermenting horse-manure. When disturbed it hops about rather lazily or flies from one branch to another, but seldom flies away for more than a few feet. It lays its eggs singly under the skin of the leaf, and wart-like specks form over the eggs. In a few days time little white grubs are hatched, which are the evil workers. * * * After two weeks energetic eating, the larva thrusts its head outside of the skin of the leaf and pupates. From the laying of the egg till the perfect fly issues from the chrysalis is within five weeks. I conclude this to be the case, from some clean cinerarias which were brought into the greenhouse in which the Marguerites were growing, the leaves of which at the end of five weeks contained not only eggs, larvæ, and pupæ, but also empty pupæ cases. The work of increase appears to proceed incessantly.

Successive Broods of the Insect.

Mr. Falconer is doubtless correct in his belief of successive broods, for from the evidence he adduces above of its maximum life-cycle, coupled with my observations, there would seem that there must be at least three broods during the autumnal and winter months. Leaves sent to me on November 14th of this year contained pupæ (crushed), indicating an appearance of the fly at about the middle of November. Flies emerged in my office from pupæ, during the middle of February last. The intervening period would give more than the required time for another brood occurring at the assumed interval of five weeks.

Larval Food-plants.

Mr. Falconer gives the following report (*loc. cit.*) of the larval food-plants:

Although the Marguerite seems to be its favorite food, it does not at all restrict itself to this plant, but attacks every other composite plant within its reach. Judging from its behavior here, it even prefers the double white feverfew to the Marguerite. It has also attacked

Eupatoriums, Gazanias, *Helianthus multiflorus*, and, as above mentioned, Cinerarias. These, at present, are about all the composites within its range. I have not observed it on any other order of plants.

Localities.

In addition to its presence at Dosoris, the insect is also operating in the greenhouse of Mr. T. L. M. Barlow, at Glen Cove Landing, and in the greenhouses at Queens, L. I., and at Hinsdale — a station on the Long Island Railroad, about fifteen miles from New York city.

Importance of Arresting its Spread.

It will be readily seen that from the prolificacy of this new insect pest, and the character of its injury to the foliage of the plants of the favorite and extensive family which it claims for its food, that it will prove, both to florists and lovers of flowers generally, an unwelcome addition to our insect fauna. It would, therefore, be well, if earnest and persistent and a successful effort can be made for destroying it in the limited locality to which it seems for the time restricted. It should be borne in mind that almost without exception, newly-introduced insect pests display a wonderful ability to inflict greater injuries in their new home than they were wont to do in their old. Up to the present, we only know this fly as a greenhouse pest. Should it be found hereafter continuing its propagation during the summer months in the garden, a great increase of harm would be the result from the large number of our valued *Compositæ* that would then be exposed to its attack.

Remedies.

Leaf-miners, like the numerous larvæ that find secure shelter within their burrows in plant-stalk and tree-trunk, or beneath the surface of the ground, are almost wholly beyond the reach of our best insecticides; and when occurring in large numbers, as does the Marguerite fly, it is useless to attempt to fight them by any of the ordinary applications which the economic entomologist is accustomed to recommend against the larger and more vulnerable class of exposed insects. Experiment can alone show the best method of meeting this newly introduced greenhouse pest. Perhaps vessels of diluted molasses and vinegar, or other liquid developing fermentation, placed in flat vessels, would attract the flies and drown them as soon as they emerge from pupæ and before they are in readiness to deposit their eggs. But, until some other successful method can be found, it would be best to examine the plants at brief intervals after the first recognition of the attack, and pick off every infested leaf and burn it. This, we learn, was done at Hinsdale in early winter, with the result of arresting the attack and securing a full bloom. Crushing the larvæ between the *thumb and* finger, as sometimes recommended, would prove too slow

and too costly an operation. When the plant is seen to be so badly attacked that the removal of the infested leaves would almost involve its defoliation, then the plant should be burned at once. By such stringent measures there is but little doubt that an attack taken at, or soon after, its commencement would be arrested.

Identified with the European Form.

As the insect and its attack seemed to be unknown in this country, examples of the fly, together with its pupæ and mines, were forwarded to Baron Osten Sacken, who readily identified it as the *Phytomyza lateralis* Fallen, of Europe, and cited the following literature upon it:

"It is figured in Curtis' *British Entomology*, vol. viii., Diptera, plate 393. The description is incorrect and misleading; a better one may be found in Schiner's Fauna.

"According to Kaltenbach, *loc. cit.*, the fly has been found in the heads of *Compositæ* (*Anthemis*, *Pyrethrum*, and *Chrysanthemum*) and also in the stems of *Centaurea* (of the *Compositæ*), *Verbena*, and *Urtica dioica*.

"Schiner quotes from *Ann. Soc. Ent. Fr.*, ii., 9, 156, to the effect that Goureau had found the larva mining in *Sonchus oleraceus*, or sow-thistle. It is nowhere else recorded as a leaf-miner."

Description of the Fly.

Curtis' description above cited, is as follows: Silky cinereous. Head and antennæ black; lip and face yellow: eyes with a reddish tinge when alive, entirely black when dead; several black bristles on the crown of the head and a row down each side of the face. Thorax with the pleuræ yellow, six longitudinal rows of strong black bristles and several of smaller ones between them. Abdomen black, shining, and pilose, a broad margin on each side beneath and the anterior edges of the segments yellow, that of the sixth being the broadest. Wings yellow at the base, nervures brown, the central one very faint. Halteres yellow. Legs black, tips of the thighs yellow.

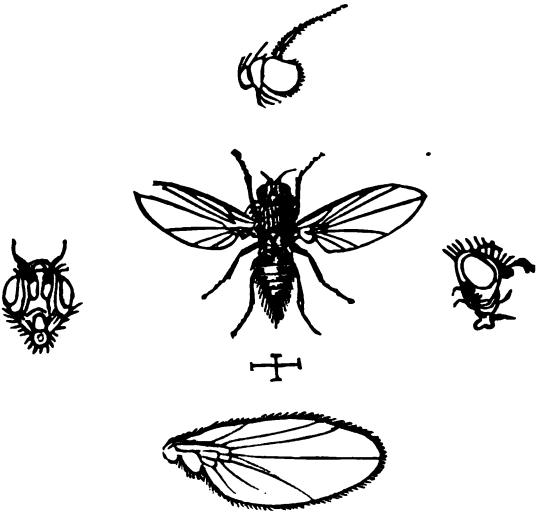

Fig. 32.—The Marguerite fly, Phytomyza lateralis, enlarged; with still greater enlargement of wing and head, the latter in different views.

Generic characters accompanying the above, which will be serviceable in identification, are the following (omitting the details of the head-parts — antennæ, proboscis, etc.) :

Head somewhat vertical, broad and rather short, pilose. *Eyes* lateral, remote, oval. *Ocelli* three, minute. *Thorax* somewhat globose. *Scutellum* subtrigonate, rounded. *Abdomen* seven-jointed in the female, ovate-conic, tapering to the apex which is furnished with a retractile tubular ovipositor. *Wings* incumbent, longer than the body, rather broad and ovate, iridescent, ciliated, subcostal nervure very short, second and third not reaching the apex, united near the base, fourth passing along the center, fifth remote, the three last united near the base by a transverse nervure. *Halteres* clavate. *Legs* nearly of equal length, slender. *Tarsi* five-jointed, basal joint the longest. *Claws* minute.

The following brief memoranda of colorational features were made by me from fresh examples of the fly :

Head and thorax ash-colored, the latter with six rows of curved black bristles. Abdomen above black except at the sutures ; beneath greenish, traversed by a broad black mesial stripe, which is narrowed before and widens to twice its anterior width behind, interrupted at the sutures. Balancers greenish, as the abdomen beneath. Legs black, the tips of the femora pale. Wings iridescent, pale at base.

Family Relations.

The *Phytomyzidæ*, to which this species belongs, is a small family which has representation in North America in only the single genus which gives it name. It finds place toward, and almost at, the end of the Brachycera — the second of the three sections in which the Diptera are divided, following after the more familiarly-known families of *Oscinidæ* and *Agromyzidæ*.

Allied Species.

Nothing, apparently, has been published by our writers of the habits of the North American species of *Phytomyza*, of which there are seven named in the Osten Sacken Catalogue of 1878. The European species seem to be more numerous, as Prof. Westwood, in his *Introduction to the Classification of Insects* (1839) has given nineteen British species, with *P. lateralis* as the type; but a recent list would doubtless differ materially from this, as the result of subsequent generic changes and discovery of additional forms.

Of the habits of *Ph. lateralis* in Europe, Prof. Westwood states (*loc. cit.*, p. 573) that its larvæ and pupæ are found in the center of the receptacles of *Pyrethrum inodorum* (corn-feverfew), there being seldom more than one in each. Glover says that "the larva forms a gall in the center of the receptacle" of the feverfew.

The larvæ of the European *Ph. flava*, according to Doubleday, are subcutaneous in the leaves of *Scolopendrium vulgare* (hart's-tongue — a fern, which also occurs, although rarely, in Central New York).

Ph. flaviceps mines the leaves of the woodbine, and *Ph. obscurella*, those of the holly (Holiday). The latter, according to Glover, feeds on honeysuckle and pupates in the earth.

Ph. nigricornis Macq., according to Curtis, mines in the underside of leaves of turnips, peas, etc., and forms long galleries beneath the lower cuticle, at the end of which the pupa is formed. Glover has figured the fly on plate x, fig. 12, of his MS. Notes on Diptera. It is also figured in Mr. Whitehead's "Report on Insects Injurious to Root and certain other Crops," 1887, as the "black-horned turnip-leaf miner." Its method of mining the leaves of turnips is shown in a figure, and described as burrowing in the parenchyma under the cuticle of the lower side of the leaf, so that it can not be seen in looking at the leaf from above. As many as eighty of its larvæ had been counted in a single Swede plant. Kaltenbach states that this species mines the leaves of monkshood [*Aconitum*].

An Aquilegia Leaf-miner of Similar Habits.

I am under many obligations to Dr. James S. Cooley, of Glen Cove, N. Y., for first calling my attention to the operations of *Phytomyza lateralis;* for sending me material from time to time for its observation, and for communicating to me information regarding it.

Dr. Cooley has also sent leaves of a columbine, *Aquilegia*, which have been destroyed by the operations of a leaf-miner, the attack of which is made only during the summer. The mines usually start at near the base of a leaf, are pretty broad even at the commencement, are wavy or curved at times in their progress toward one of the lobes, where they terminate, not in a blotch, for the larvæ leave them (probably for pupation in the ground) at this point, through a rupture of the cuticle (often crescentic) at their outer margin. The mines, of which there may be three or four on a single

Fig. 33.—Columbine leaves showing operations of an unknown leaf-miner.

leaf, are seen only from the upper surface. They are white, crinkled, conspicuous, and with the small excremental grains often deposited in two parallel lines near the margins.

Effort will be made the coming summer to procure the insect producing these mines, which may perhaps prove to be another species of *Phytomyza*.

Megilla maculata (De Geer).

The Spotted Lady-bird.

(Ord. COLEOPTERA: Fam. COCCINELLIDÆ.)

Coccinella maculata DE GEER: Mem. Hist. Ins., v, 1775, p. 392, pl. 16, fig. 22.

Coccinella 10-*maculata* FABRICIUS: Spec. Ins., i, 1781, p. 99, No. 29; Mant. Ins., 1787, p. 57, No. 44.

Hippodamia maculata MELSHEIMER: Cat. Coleop. U. S., 1853, p. 129.—GLOVER: in Rept. Comm. Agricul. for 1866, p. 41 (parasitic attack); id. for 1874, p. 123 (feeds on Colorado potato-beetle eggs).—WALSH-RILEY: in Amer. Entomol., i, 1868, p. 46, fig. 36; p. 186, fig. 138: p. 194, fig. 135.—RILEY: 1st Rept. Ins. Mo., 1869, p. 112, fig. 49.—PACKARD: Guide Stud. Ins., 1869, p. 511, fig. 509 (mention).—REED: in 2d Rept. Ent. Soc. Ont. for 1871, p. 71-2, fig. 72.—SAUNDERS: in 8th Rept. E. S. O. for 1877, p. 36, fig. 10.—WILLIAMS: in 9th Rept. E. S. O. for 1878, pp. 43, 44, fig. 30.—COMSTOCK: in Rept. Comm. Agricul. for 1879, p. 177, fig. 30 (mention).—FORBES: Bull. 6, Ill. St. Lab. Nat. Hist., 1883, pp. 51, 52 (food); 14th Rept. Ins. Ill., 1885, p. 21-2 (eats corn).

Megilla maculata CROTCH: Ch List. Coleop. N. A., 1873, p. 49, No. 2823; in Trans. Am. Ent. Soc., iv, 1873, p. 364 (description).—WEBSTER: in Bull. 3, Ill. St. Lab. N. H., 1880, p. 152; in Amer. Entomol., iii, 1880, p. 173 (eats pollen).—RILEY: in Amer. Nat., xv, 1881, p. 326 (feeds on corn); id., xvii, 1883, p. 322-3 (food-habits).—GRIFFITH: in Amer. Nat., xvi, 1882, p. 408 (eaten by *Microcentrus retinervum*).—LINTNER: in Count. Gent., xlviii, 1883, p. 941 (a corn pest).—SAUNDERS: Ins. Inj. Fruits, 1883, p. 125, fig. 129.—DIMMOCK: in Cassino's Stand. Nat. Hist., ii, 1884, p. 312.—HUNT: in Miss. Ess. Econ. Ent., 1886, p. 92-3 (bibliog. of corn insects).—HOWARD: Bull. 17, Chinch Bug; Div. Ent., U. S. Dept. Agricul., 1888, p. 22, fig. 4 (food).

A New Corn Pest.

In the autumn of 1883, beetles sent for name, from Fairfield, Conn., as "making bad work with corn," were identified as this species. In response to the inquiry made of them, the following communication was published, substantially, in the *Country Gentleman*, of November 22, 1883.

The insects sent are "lady-bugs," of the species popularly named "the spotted lady-bird," and the *Megilla maculata* of our present cata-

logues — formerly *Hippodamia maculata*. Its detection on corn, as above, is of special interest, as it is the third time that testimony has been borne to the effect that the above species, for a long time thought to be entirely harmless, may, under certain circumstances, become decidedly injurious.

Not all of the Lady-bugs are Carnivorous.

The family of *Coccinellidæ*, comprising the lady-bugs, has been regarded as entirely carnivorous, and as the food of very many of the species consists largely of plant-lice, they have been taken under the protection of entomologists and of all others who knew of the great service that they render in checking the prodigious multiplication of the destructive aphides. Within a few years past it has come to light that the members of the family are by no means exclusively confined to an animal diet, but that a number of them subsist, in part, upon vegetable food. In several of the species it constitute the larger proportion of their diet. This has been brought out by the pains-taking studies made by Professor Forbes, State Entomologist of Illinois. In a valuable paper published by him, in *Bulletin No. 6, of the Illinois State Laboratory of Natural History*, January, 1883, entitled "The Food Relations of the Carabidæ and Coccinellidæ," 31 pages, the results are given of the examination of the contents of the alimentary canal of twenty-one specimens of lady-bugs (*Coccinellidæ*), collected at different times throughout the year, and in various localities, mounted on glass slides, and examined under high magnifying powers. It was ascertained that more than one-half of their food (fifty-three per cent.) had consisted of vegetable matter — mainly the spores of fungi. Of the animal food, above one-third (thirty-six per cent.) was of plant-lice.

We would be very glad if the above investigations, while they have served to greatly extend the known range of food of our pretty friends — the lady-birds — and by their consumption of the spores of useless lichens and noxious fungi, to place us under additional obligations to them, could also have shown us that their mouth-parts were of such a structure as to limit their diet to insect pests and worthless vegetation. But other observations have told us a different story.

The Leaves of Corn Eaten by the Beetle.

In the summer of 1874, an insect, which proved to be *Megilla maculata* — the same as the species above mentioned — was sent from St. Inigoes, Md., with the statement that it had done considerable injury to corn by eating holes in the blades (*American Naturalist*, for April, 1881, xv. p. 326). Upon the attempt being made

by Professor Riley to verify this statement, which was at variance with previous knowledge of the insect's habits, negative results were obtained, as the beetles refused to eat tender leaves of corn, grape-vine, clover, et cet., offered to them.

The Beetle seen Feeding on Corn in the Ear.

In August of 1882, Mr. Pergande, of the Entomological Division of the Department of Agriculture, while searching for injurious insects on corn, near Washington, "saw several imagos and larvæ of this species actually eating into the soft kernels of the ear. The beetles were almost entirely hidden within the nearly empty kernels, and it could plainly be observed that they were eating. Upon removing them, the most careful observations failed to disclose any other insect in the kernel. The larvæ were found in similar situations, actually engaged in eating the substance of the soft seeds." (*American Naturalist*, for March, 1883, xvii, page 323.)

In reply to my request made to the gentleman, Mr. Sturges, of Fairfield, Conn., who had sent the beetles, for additional information in regard to their attack on his corn, he has written as follows:

I send you herewith some ends of corn eaten, as I suppose, by the bug. I at first thought that the damage was done by birds, but I found the bug under the leaves, and I watched closely, and in every ear I discovered some of these in the kernels. The corn was then in the milk and the kernel soft. As the corn hardened the eating stopped.

I have found them in three pieces of corn, widely separated, and also in my garden. All of the bugs that I sent you were taken out of kernels.

Its Manner of Feeding on the Corn.

Twelve of the beetles were sent me by Mr. Sturges. The ends of ears, of which there were a number, are eaten from two to nearly five inches downward from the tip. The interior of the kernels is entirely eaten, leaving only the outer shell, dried, black, and shriveled. Where the injury has been the greater, it is seen to have extended by holes eaten into the sides of the kernels adjoining the already eaten portions, quite unlike an opening made by a bird, and, judging from accounts, after the same manner of the like injury committed by another corn-pest recently brought to light, viz., *Diabrotica longicornis* (Say) — one of the *Chrysomelidæ*.

The corn-eating propensity of the beetle is also confirmed by observations of Professor Forbes, given in the Fourteenth Illinois Report, as follows: "Last August we saw it eating the exposed kernels at the tip of the ear, hollowing out their substance, and partly buried in the cavities thus made."

In consideration of the above authorities and circumstantial statements, we are compelled to admit that the Megilla does, occasionally at least, become injurious to corn. It is known to occur in great abundance, at times. I have seen it during the month of August collected by hundreds around the base of some honey-locusts (*Gleditschia triacanthos*), between the trunk and ground, at Middleburgh, N. Y. It has also been reported as found "lying in piles under the leaves and grass about the roots of apple trees, and always upon the south side of the tree." (*American Entomologist*, i, 1869, page 186.)

Its Injuries to Corn not of Frequent Occurrence.

At times of such abundance as above, it may be driven for sustenance to other than its ordinary food. Should this prove to be the explanation of its occasional foray upon our cornfields, we should not find fault with it, if by way of dessert it should indulge moderately in corn-in-the-milk, after all the substantial viands of its accustomed bill of fare, as plant-lice, chinch-bugs and Colorado potato-beetles in the egg, have been consumed. The vast amount of service that it renders us entitles it to all the praise that we have hitherto bestowed upon it, and all the protection that we have endeavored to extend to it previously to the discovery of this one bad trait in its perhaps otherwise faultless habits.

The Beetle Described.

That similar attacks upon corn by this insect may be recognized and reported, the following description of it is given, together with an enlarged representation of it and of its earlier stages :

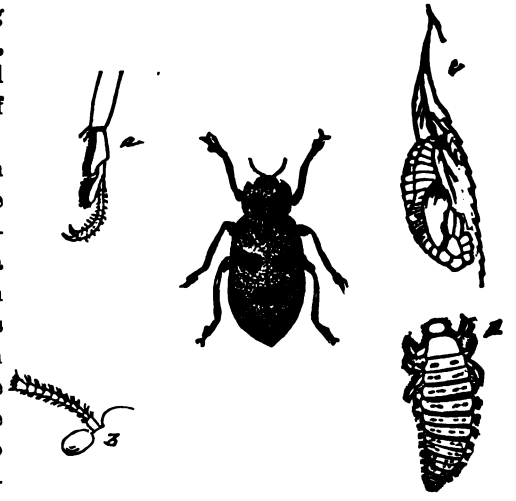

Fig. 34.—Megilla maculata: *a*, tarsus; *b*, antenna; *d*, larva; *c*, pupa—all enlarged. (After Emmons.)

The beetle is one-fourth of an inch long, more elongate-oval than the lady-bugs usually are, and of a peculiar red color, often called pink. The head is black, with the exception of a median red line. More than half the area of the thorax is occupied by two pyriform black spots, narrowed behind. On the wing-covers are ten black spots, of which the three anterior ones are in line, followed by two

larger on the middle, then by three others, and last by two on the tips of the covers; one-half of the central one in each line of three spots rests on each wing-cover. The legs and body beneath, except its margin, are black.

Its Extended Distribution.

This insect has an unusually wide distribution over the world, occurring in Canada, the United States, Central America, South America and Europe.

Chauliognathus marginatus (Fabr.).

The Margined Soldier-Beetle.

(Ord. COLEOPTERA : Fam. LAMPYRIDÆ.)

FABRICIUS: Syst. Ent., 1775, p. 206; Spec. Ins., 1781, p. 259, No. 8; Mant. Ins., 1787, p. 157, No. 9 (*Cantharis marginata*).
HENTZ: in Trans. Amer. Philos. Soc., 2d Ser., iii, 1830, p. 460, pl. 15, figs. 1, *a–f* (description, habits and peculiar structure).
LECONTE: in Proc. Acad. Nat. Sci. Phil., v, 1851, p. 338 (as *C. Hentzii)*; in Trans. Amer. Ent. Soc., ix, 1881, pp. 44, 68.
WALSH: in Amer. Entomol., i, 1868, p. 52 (compared with *C. Pennsylvanicus*).
RILEY: 5th Rept. Ins. Mo., 1873, p. 154 (food-habits).
PROVANCHER: Pet. Faun. Entomolog. Can.—Coleop., 1877, p. 414–5 (descrip.).
GLOVER: MS. Notes Journ.—Cotton, 1878, pl. 13, fig. 6 (on cotton).
TRELEASE: in Comstock's Cotton Ins., 1879, p. 322 (food).
LINTNER: in Count. Gent., xlix, 1884, p. 897 (larva in apples).
HENSHAW: List Coleop. N. A. Amer., 1885, p. 77, No. 4876.

The Insect Mistaken for a Fruit Pest.

The need of such a knowledge of insects as will enable the agriculturist, the fruit-grower, etc., to know and readily recognize his insect friends, and thereby spare them so far as may be from the destruction with which he would visit his insect foes, has often been urged by entomological writers. Such need is shown in the following note received:

Inclosed please find specimens of an insect very destructive to our better class of apples — wine saps, etc. I should like to learn its name, habits, and how to meet it practically. This larva makes a round hole in the apples sideways, enlarging the hole often to half or three-quarters of an inch in diameter, when, as a result, the apple rots and drops. To destroy the larva by hand would necessitate removal of more than one-sixth of the crop — too slow and not thorough, for obvious reasons. The small ants attack the insect, biting into its back, and adhering sometimes, but without effect. The larger ants, bugs (of the white grub transformation), etc., feed in company with the insect. Quinces rot enormously, and, in about two-thirds of the specimens on the ground, I find the holes probably made by this same insect.

Importance of Knowing our Many Insect Friends.

The above communication is a strong argument in favor of the importance of the study of the habits of insects by the economic entomologist, and the distribution of the knowledge thus obtained through publications easily to be understood, illustrated with good figures, and accessible to all to whom they may be of service.

It should generally be known that not all insects are injurious. There are those that are the farmer's best allies, though often occurring under circumstances so suspicious as usually to cost them their lives. Of these are the numerous species of "lady-birds," or "lady-bugs," which often abound upon sickly vegetation infested with plant-lice, where they have been drawn to feed upon the destructive aphides. Nearly all of the entire family of *Ichneumonidæ* (ichneumon flies) are of great service to the agriculturist, from the immense number of caterpillars which they destroy. Many of the *Hemiptera* (bugs) prey upon caterpillars and other injurious forms. A large proportion of the *Lampyridæ* — the family of beetles to which the "lightning-bugs" or "fire-flies" belong — feed upon other insects in both their larval and perfect stages.

Appearance of the Larva of Chauliognathus.

It is to this last-named family (or the sub-family of *Telephoridæ*) that the insect pertains, of which inquiry is made. As stated, the example sent was in its larval stage. It has the form characteristic of many of the Coleoptera — a head of goodly size armed with stout jaws, a thorax not much larger than the head, bearing six conspicuous legs, and a long, soft abdomen, somewhat broader centrally. This particular one is dark brown in color and of a peculiar velvety appearance, not differing greatly from some of its congenors. It was identified by Prof. Riley as *Chauliognathus marginatus* (Fabr.).

The Margined Soldier-Beetle, a Beneficial Insect.

It is the first time that the margined soldier-beetle (its common name) has been noticed under circumstances that show it to be entitled to a place among our beneficial insects, although its habits were previously suspected. There can be no doubt but that it was drawn to the fruit in such numbers as above stated (infesting one-sixth of the entire crop), for no other purpose than to feed on the common apple-worm, the larva of the codling moth, *Carpocapsa pomonella*. It would naturally, we think, enter the fruit in search of its prey, through the hole already made by the apple-worm in the side of the apple for the discharge of its excrements, and for its final exit. But in the event of the hole being too small for entrance, its enlarge-

ment would be necessary, and if, as we infer from the above communication, it has been actually seen eating into the fruit, it would probably be while engaged in such enlargement. It would be an interesting fact if it had been observed in the act of making a perforation where none previously existed.

Service Rendered by the Pennsylvania Soldier-Beetle.

In the Fourth Report of Prof. Riley on the insects of Missouri (page 28), he notes his discovery that the larva of another species of *Chauliognathus* — the *C. Pennsylvanicus* of De Geer (the *C. Americanus* of Forster), "destroys the apple-worm while leaving the fruit, and in all probability, seeks them out while in the fruit." It had previously been known to prey upon the larva of the plum curculio. Figures of the insect in its larval and perfect stages are here given. In its final stage of a beetle — quite in contrast with its earlier life, it is believed to feed only on the pollen of flowers; and actively engaged in this pursuit, it may be found abroad during the months of August, September and October. From the 5th to the 18th of August, 1884, it was observed by me in unusually large numbers upon the blossoms of the golden-rod, *Solidago*, at Palenville, N. Y., the larger proportion of the individuals occurring at that time mated.

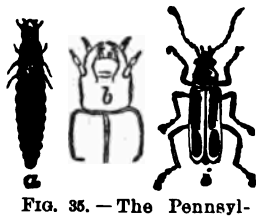

FIG. 35. — The Pennsylvania soldier-beetle, CHAULIOGNATHUS PENNSYLVANICUS; *a*, the larva; *b*, its head enlarged; *i*, the beetle.

Comparison of the Two Soldier-Beetles.

C. Pennsylvanicus has frequently been figured in Entomological reports, as, in addition to the previous citation — in the First Missouri Report, p. 19; Fourth Illinois Report, p. 108; American Entomologist, p. 51, "A Friend Unmasked;" Packard's Guide, p. 487, etc. By referring to the figures given, with the aid of the following quotation from Walsh, its congener, *Chauliognathus marginatus* — the newly detected apple-worm eater — may easily be recognized in its beetle state.

A very closely allied species [to *C. Pennsylvanicus*], the margined soldier-beetle (*Ch. marginatus* Fabr.) swarms everywhere in South Illinois in June and July, on the flowers of the blackberry, the redroot, etc., but it is not met with in the more northerly parts of the State. It might be readily mistaken at first sight for the other one, but is distinguished by being several times smaller, and by usually having its entire wing-cases except a very narrow yellow margin all around (hence comes the specific name) occupied by the black color, which in the other species forms a mere black patch at the tip.

The following is added to the above in relation to the supposed habits of the larva: "The habits [carnivorous] of the two are doubtless the same, or nearly the same. Spare their lives, I beg and pray you, for your own sake, ye pitiless haters of everything that ye have chosen to label with the three ominous letters —B U G! Ye may not, perhaps, care for bugs, but I know that ye dearly love peaches." (The Pennsylvania soldier-bug has been found abundantly in and beneath peaches lying upon the ground, infested with the curculio.)

The eggs of the margined soldier-beetle are probably deposited loosely in masses in the ground during the month of July, to hatch into larvæ and to mature slowly, after the habits of the other species with which it has been compared, as detailed in the *Second Report of the United States Entomological Commission*, p. 261–2.

C. marginatus may Feed on the Quince Curculio.

The holes in the quinces, of which mention is made in the communication given on page 84, if originally smooth and round, were probably bored by the larva of the quince curculio (*Conotrachelus cratægi* Walsh) as it emerged from the fruit in August or September for its winter burial in the ground. Through these holes the soldier-beetle larva might enter the fruit in search of the remaining curculio larvæ, of which there are often several in the same quince, as these would doubtless prove quite as palatable to it as the apple-worm.

Observations Desired.

Careful observation and account of the actions of the larvæ of the soldier-beetles in their search for, and while preying upon, the apple worm or other insects, would be an acceptable contribution to their history, which we hope may be ere long supplied by some of our fruit growers who have recognized the importance to them of the study of insect-habits.

Description of the Beetle.

Yellow-orange. Antennæ and palpi brown, yellowish at the base. Head with a large black spot on the vertex, bifurcating to meet the eyes. Prothorax a little longer than broad; its sides straight, lightly rounded before, with a broad longitudinal black band in the middle. Wing-covers elongated, narrow, yellow, margined with a paler line and bearing near to its extremity a black spot more or less elongated. Beneath yellow; prosternum, with the extremities of the femora, tibiæ, and tarsi more or less darker. Length 0.40 inch.

Var. Wing-covers entirely brown with the exception of their pale yellow margin. (Provancher, *loc. cit.*)

It will be seen that the black coloring on the wing-covers varies greatly in this species, as it does also in *C. Pennsylvanicus*, in which it sometimes covers nearly the entire surface.

The synoptical characters given by Dr. LeConte, in his admirable "Synopsis of the Lampyridæ of the United States" (*Trans. Amer. Ent. Soc.*, ix, 1881, pp. 15-72), are the following:

Prothorax longer than wide, opake yellow, with a broad, black, dorsal stripe, sides very narrowly margined; elytra with discoidal spot sometimes extending nearly the entire length, sometimes wanting. Length 8–11 mm., = .32–.44 inch. New York; Florida.

Sitodrepa panicea (Linn.),

AS A LEATHER-BEETLE.

(Ord. COLEOPTERA: Fam. PTINIDÆ.)

Dermestes paniceus LINN.: Syst. Nat., ii, 1767, p. 564, No. 19.
" " FABR.: Syst. Ent., 1775, p. 57, 14; Spec. Ins., i, 1781, p. 66, No. 18; Mant. Ins., i, 1787, p. 35, No. 22.
Anobium obesum SAY: in Journ. Acad. Nat. Sci. Phil., v, 1825, p. 173; Compl. Writ., ii, 1883, p. 281.
" " MELSHEIMER: in Proc. Acad. Nat. Sci. Phil., ii, 1844, p. 309.
" " GLOVER: in Rept. Commis. Pat. for 1854, p. 72, pl. 5 (in wheat from Algeria).
" *paniceum* HORN: in Proc. Ent. Soc. Phil., i, 1861, p. 29 (food and pupation).
Sitodrepa panicea GLOVER: in Rept. Commis. Agr. for 1868, p. 98, fig. 152 (transformation, food, etc.); id. for 1870, p. 66 (tobacco, etc., eaten).
" " LECONTE: in Proc. Acad. Nat. Sci. Phil. for 1865, p. 229.
" " PACKARD: Guide Stud. Ins., 1869, p. 470, fig. 440 of larva, p. 131 (parasitic [?] on humble bees).
" " SHIMER: in Amer. Entomol., ii, 1870, p. 323, fig. 200 (feeding habits).
" " THOMAS: 6th Rept. Ins. Ill. [1877], p. 122, fig. 12 (description, habits, etc.).
" " SAUNDERS, W. E.: in Canad. Entomol., xv, 1883, p. 80 (a drug pest).
" " HAMILTON: in Canad. Entomol., xv, 1883, p. 92 (a museum pest).
" " HENSHAW: List. Coleop. N. Amer., 1885, p. 63, No. 5267.

An Insect Attack on Leather Reported.

A letter was received under date of May 10, 1887, from the editor of "Boots and Shoes,"—a weekly journal published in the city of New York—stating:

"One of our subscribers writes that he has had a lot of shoes ruined by a small bug which burrows into the leather and deposits its eggs, perforating the leather in all directions. He would like to know the nature of this bug, and also how to prevent further ravages in his

stock. Can you, without seeing the bug, suggest what it probably is, and a remedy? If so you will confer a favor on the writer as well as the subscribers of "Boots and Shoes."

Dermestes vulpinus as a Leather-beetle.

To the above, reply was made to the following effect: The depredator is probably the *Dermestes vulpinus*, or the leather-beetle. It has for some time been known to be injurious to skins and hides, and has also been found abundantly about some bone-boiling works in England. Two years ago, it was brought to the notice of Prof. Riley (see his report, in that of the Commissioner of the Department of Agriculture, for the year 1885, pp. 258–264 [from which the accompanying illustrations have been obtained], as occurring in a number of wholesale boot and shoe houses in St. Louis, where boxes of shoes that had been packed for some time, were swarming with the insect in the different stages of its development. It was observed that the soles and heels of boots and shoes were more liable to be injured than the uppers, probably resulting from the oily dressing used in the latter. The operations of the larva are described as boring round and smooth holes through the leather in every direction, very often entering the shoe at the joining of the heel with the sole, or at any point in the crevice between the upper and the sole, where the larva could find the purchase for its boring.

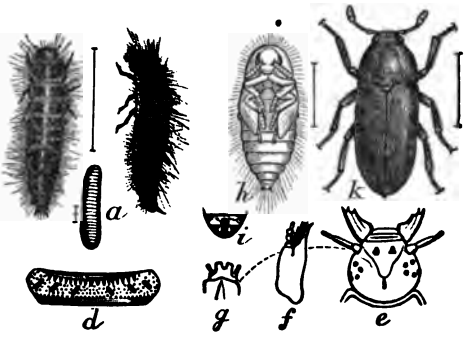

FIG. 36.—The Leather-beetle, DERMESTES VULPINUS: *a*, egg, and larva; *h*, pupa; *k*, beetle; *d*, a denuded middle joint of the larva to show spines, etc.; *i*, ventral view of tip of abdomen of male beetle; *e*, head of larva; *f*, maxilla and palpus of same; *g*, labium with palpi—enlarged.

The larva sometimes transforms to the pupa state within the leather, but it usually leaves it for a crack in the box containing the shoes, or in the floor adjoining, where it burrows out a suitable place for its change to the pupal and perfect stages.

The beetle, also, is injurious to the leather by gnawing its surface, but it does not burrow into it as does the larva.

Professor Riley, in the paper cited, offers the following remedies for its attack:

The contents of the infested cases of boots and shoes might be overhauled and treated with benzine or some other efficient insecticide.

The larva could be destroyed by placing an open saucer containing

bisulphide of carbon on the top of the contents, the heavy vapor of which, if the box is a tight one, will fall downward and kill the insects within.

To the above, I would add the suggestion that a degree of heat might easily be applied to the infested stock that would suffice to destroy the larvæ without injury to the leather.

Sitodrepa panicea also Eats Leather.

Another beetle, which is widely distributed over the civilized world, and is such a general feeder that it has been said of it that "it will eat anything except cast iron," viz., *Sitodrepa panicea* (Linn.), has also been brought to my notice in former years as having injured boots and shoes. But in this instance, it is probably the first-named species that is the culprit. If it be so, it may be known from the statement above given of the manner in which it does its work.

Sitodrepa the Author of the Reported Injury.

Later, one of the infested shoes was sent to me at my request, which permitted identification of the author of the injury by giving forth several of the beetles. The editor of "Boots and Shoes" was accordingly written, substantially, as follows, the communication appearing in the issue of June fifteenth :

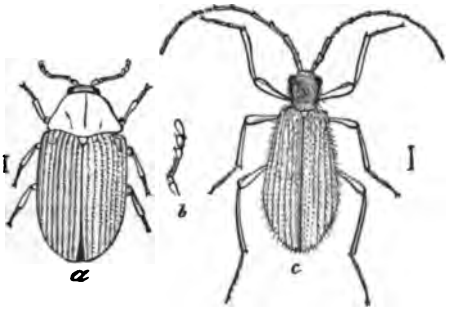

FIG. 37.—*a*, SITODREPA PANICEA; *b*, antenna of same; *c*, PTINUS BRUNNEUS.

The insect previously reported to me as burrowing into shoes, and which, in consideration of the few particulars given me of the nature of its operations, was believed to be *Dermestes vulpinus*, is found to be another insect — the second one that was suggested as the possible culprit, viz., *Sitodrepa panicea*. [The beetle is shown at *a*, in figure 37.]

Nature of its Injuries.

The shoe containing the larvæ, subsequently sent to me by your direction, to show the nature of the attack, was duly received. It is an Oxford strap of calf with kid uppers. If I may judge from its shape and general appearance, it is not of recent manufacture, but has been in stock for some time. Perhaps its age may have invited the attack. The nature of the injury to the shoe is as follows: In two places on the side where the vamping is stitched to the upper, the

former is cut through just below the stitching—on one side to the extent of about an inch — showing the leather within to be nearly all eaten away by the burrowing of the larvæ of the beetles. The extent of the burrowing in other parts of the shoe can not be stated, as it is not permitted to take it apart for further examination. It is inferred, however, that a large portion of the leather has been burrowed in the same manner, judging from the number of little round holes of the diameter of the beetle eaten through the calf just below, within a half-inch of the stitching. The holes are as round as if they had been cut by a punch, and their slight difference in diameter is evidently caused by the difference in size of the beetles. Of these holes, sixty-six were counted, indicating as many beetles, which, having completed their transformations, had eaten their way outwardly, for their escape. That the holes were made in this manner and for this purpose, is evident by their enlarged size within (somewhat funnel-shaped), and the small pile of powdered leather that lay in the box in which the shoe had been placed, beneath the point of exit of each of the five beetles that have escaped during the week that the shoe has been under observation. There may still be many within it, to mature and escape hereafter.

The kid-upper also shows two of the holes near the stitching and one at the upper edge near the binding. The last named one appears as if it may have been eaten inwardly from the outside.

I judge from the indications that the eggs of the parent beetle had been deposited at the upper edge of the stitching, and that the larvæ upon hatching had burrowed downward beneath it.

Mr. Myer Mandelbaum, boot and shoe dealer of this city, to whom the attack was shown, stated to me that he had in one instance seen shoes, purchased in New York, that had been perforated in the same manner, although not to an equal extent.

Sitodrepa Almost Omnivorous.

This beetle, *Sitodrepa panicea*, has long been known to science, and has often been written of, it being a common species which has been distributed through commerce over nearly all the civilized world. While many of the beetles are confined to one article of food, this is remarkable for its feeding on a very large number of substances differing greatly in character. I have known it to occur abundantly in the cayenne of druggists, feeding in its larval state on this pungent material, and making of the powder little cells within which it transformed to the pupa, and subsequently to the perfect insect. It is a well-known pest in drug stores, as will appear from the extended

list of drugs, in which it has been reported as occurring, by Mr. Wm. E. Saunders, of London, Ontario, viz.: Aconite root, bitter almonds, sweet almonds, angelica, boneset, calumba, chamomile, chocolate, coriander, dandelion, elm bark, ergot, extract of licorice, German chamomile, orris root, prince's pine, rhubarb, squill, and sweet flag. (*Canadian Entomologist*, 1883, xv., p. 81.)

It is also reported as feeding on collections of dried plants, collections of insects, cork in insect cases, binding of books, wafers, ginger, cantharides, stored wheat, flour, stale bread, ship biscuit, barley meal, oatmeal, beads made of a certain paste, etc. According to Dr. Packard, it is occasionally parasitic on honey-bees.

Will Probably not Become a Leather Pest.

From the above statements, length of time during which the species has been known, its extensive distribution, and its almost omnivorous habits, the inference may safely be drawn that this beetle will never present itself as a serious leather pest unless it shall be permitted to continue a local attack and multiply itself without efforts made for its arrest. In the greatly extended range of its food, there are many substances upon which it would feed in preference.

How its Attack on Shoes may be Arrested.

An attack by it on boots and shoes in stores can be arrested by the means published in my former communication. If but a few shoes are found to be infested, the insect, in any of its four stages in which it may be present, may be killed by oiling the leather with a sufficient quantity of kerosene to permit of its penetration so as to reach the insect. Kerosene is an infallible insecticide in all cases where it may be safely applied.

Another Leather-eating Beetle.

Associated with *Sitodrepa panicea* in Figure 37, is another beetle, *Ptinus brunneus* Duftsch, the larva of which has shown a peculiar fondness for leather, especially when it has been used in the binding of books. Dr. Shimer has written of its operations in his library, in the *American Entomologist*, ii, 1870, p. 322, as follows:

They usually operate in leather-bound or half-bound volumes, by boring galleries along in the leather where it is joined to the back of the leaves of the book; most frequently about the lineal angle formed by the board-back, and the edge of the back of the leaves. Sometimes they are in the middle of the back, or about its corners. They usually bore along quite under the surface of leather, cutting it almost through; occasionally a small round hole penetrates through the leather to the outer surface. The galleries are filled with the debris. Sheep-bound books seem to be their favorite resort.

This species has not yet, to my knowledge, shown itself as a museum pest, feeding upon objects of natural history, but it may become so enrolled at any day, in the company of two of its congeners — *Ptinus fur* Linn., as recorded by Dr. Hagen,* and *Ptinus quadrimaculatus* Melsh., from my own experience. Several examples of the latter were discovered, dead, in the month of February, in a case of dragon-flies which had been received the preceding summer from South Britain, Conn. Two examples of the same had previously occurred in another case of insects, in which they had evidently undergone their transformations and committed some damage.

Xylotrechus colonus (Fabr.).

(Ord. Coleoptera: Fam. Cerambycidæ.)

Fabricius: Syst. Ent., 1775, p. 91; Syst. El., 1801, p. 345 (*Clytus*).
Olivier: Ent., iv, 1795, genus 70, p. 31, t. 6, fig. 67 (as *Callidium*).
LeConte: in Journ. Acad. Nat. Sci. Phil., ser. 2, ii, 1850, pp. 28, 104 (as *C. agrestis*).
Melsheimer: Cat. Coleop. U. S., 1853, p. 105 (as *Clytus campestris*).
Provancher: Pet. Faun. Ent. Can.—Coleop., 1877, p. 599 (description).
Packard: Bull. 7, U. S. Ent. Comm.—For.-Sh. Trees, 1881, p. 27 (as *Clytus*, pupa descr.), p. 114 (mention); 3d Rept. U. S. Ent. Comm., 1883, p. 258 (description of larva), pl. xii, figs. 2, 2a, 3.
Riley: in Amer. Ent., iii, 1883, p. 239 (bred from oak).
Henshaw: List Coleop. N. Amer., 1885, p. 99, No. 6179.
Leng: in Ent. Amer., ii, 1887, p. 200 (European synonymy and references).

The Beetle Described.

The following description of the beetle is that given by l'abbé Provancher, *loc. cit.* It is stated to be a common species in Canada:

Fig. 38.—Xylotrechus colonus, enlarged. (After Emmons.)

Brown, more or less deep. Front with two approaching longitudinal carinæ, a little more separated between the antennæ. Antennæ reddish, lighter at the extremities. Prothorax with numerous transverse striæ, subcylindrical, with a spot at each angle not very distinct. Wing-covers with two broad transverse bands, the first yellowish-white near the base, and the second, reddish-white at the extremity; this last with a black spot in the middle, and the first often with a point mounting to the scutellum, near the suture, and inclosing another detached spot near the shoulder. Feet reddish with white hairs; femora (thighs) strongly clubbed. Length, 0.50 inch.

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* *Proceedings of the Boston Society of Natural History*, xx, 1878, p. 59.

The Beetle Abundant in a Dwelling-house.

Examples of this beetle, represented in enlargement in Fig. 38, occurred quite frequently in a dwelling-house in Albany, during the month of March. Their distribution through different rooms on the several floors where they had never been observed before, excited curiosity as to their source.

In reply to inquiry made for their name and some information respecting them, answer was returned that they were a species of Longicorn beetle, bearing the scientific designation of *Xylotrechus colonus*, but which was not sufficiently common or of enough economic importance to have received a popular name. (Dr. Packard has designated it as "the common oak Clytus," from the tree which it more usually infests, and the genus to which it was formerly referred.) It was, however, by no means rare in the State of New York, and it not unfrequently fell into the collector's hand in his field excursions.

Limited Knowledge of the Insect.

Little seems to have been written of its habits or life-history, beyond the brief account given by Dr. Packard, viz.: The larva excavates broad, shallow, and irregularly sinuous burrows, about five mm. wide, at its broadest part between the bark and wood of the oak, upward and downward, and extending partly around the trunk. The larvæ, pupæ, and imago may be found in these burrows in the month of May and early June. The newly transformed beetle has been taken as early as the 27th of May. The beetle has also been found under the bark of an old sugar maple in the Adirondack Mountains, N. Y. The figure of the larva given, is from Dr. Packard's "Descriptions of the Larvæ of Injurious Forest Insects," illustrated in ten plates, contained in the 3d *Report of the U. S. Entomological Commission.*

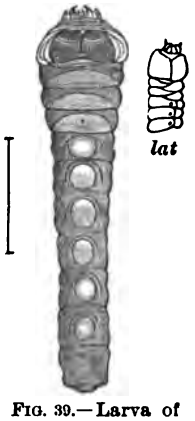

FIG. 39.—Larva of XYLOTRECHUS COLONUS.

How it May Have Been Introduced within Doors.

The species of the family to which it belongs (*Cerambycidæ*) are seldom seen within doors, and no satisfactory reason can be assigned for the presence of *X. colonus* in such numbers as reported in the present instance. They may perhaps have been contained as larvæ or pupæ in maple or oak fuel, if such was used in the house, or in furniture made of these woods, and their appearing in their final stage of perfected beetles at so early a season, may have been the result of the higher within-door temperature to which they had been subjected.

Long Imprisonment of Beetles within Furniture.

Many instances are recorded where different species of longicorn beetles have made their escape from furniture within the wood of which they had lived as larvæ, after a period of years so greatly in excess of what is known of the natural term of life in the larval and pupal stages of the same insects, that the statements, if accepted, can only be explained through the operation of the artificial conditions under which they had been placed. It is not impossible, that in such instances of unnaturally prolonged lives, there may have resulted a lethargic condition in which respiration and accompanying phenomena were almost or entirely suspended through the complete exclusion of air (a hermetic sealing) by the rubbing, oiling, varnishing, or other polishing which the furniture had undergone.

As an example of such prolonged vitality, the following extract is made from the Third Report on the Insects of New York, by Dr. Fitch (3d–5th Reports, 1859, p. 8), compiled from a more extended notice contained in the History of the County of Berkshire, published at Pittsfield, 1829, p. 39:

In 1786, a son of Gen. Israel Putnam, residing in Williamstown, Mass., had a table made from one of his apple trees. Many years afterwards the gnawing of an insect was heard in one of the leaves of this table, which noise continued for a year or two, when a large, long-horned beetle made its exit therefrom. Subsequently the same noise was heard again, and another insect, and afterwards a third, all of the same kind, issued from this table leaf — the first one coming out twenty, and the last one twenty-eight, years after the tree was cut down.

From evidence obtained by Dr. Fitch, he believed that there could be no doubt but that the insect was the longicorn beetle *Cerasphorus balteatus*, figured on Plate 1, fig. 8, of the Report above cited — now known as *Chion cinctus* (Drury).

In Silliman's Journal of Science and Arts, vol. x, 1826, p. 65, is a short reference to a more detailed notice elsewhere, of an insect believed by the writer to have been a species of *Urocerus* — a large hymenopterous insect commonly known as a "horn-tail" — which had escaped from a table made of an apple-tree, twenty-eight years after the cutting of the tree. It would appear as if the two accounts might refer to the same occurrence.

Silliman's Journal, vol. ix., p. 85, copies from Brewster's Edinburgh Journal, No. 3, p. 85, a paper on the escape of an *Urocerus* (different from *U. gigas*) from a table made of deal and veneered with mahogany, in England, but without giving the age of the table or other desirable particulars.

Xylotrechus Probably Conveyed in Hickory Wood.

Subsequently to the reply made to the inquiry of the probable cause of the presence of *X. colonus*, it was learned that a half-cord of hickory fire-wood had been stored in the basement of the dwelling in which the beetles made their appearance. There is, therefore, hardly room for doubt that they had escaped from the wood, and that the insect, at times, may infest hickory, in addition to oak and maple.

Xylotrechus colonus, described by Fabricius in 1775, has an extensive distribution throughout the United States east of the Rocky Mountains. According to l'abbé Provancher, it is not uncommon in Canada. Its European synonymy and bibliography may be found in Mr. Leng's "Synopses of the Cerambycidæ," *Entomologica Americana*, ii., 1887, p. 200.

Examples of a congener of the above — *X. undulatus* (Say), have been taken by Mr. Erastus Corning, Jr., of Albany, at Murray Bay, Canada, in the month of August, as they were emerging from their burrows in the trunks of spruces. The species has not been previously recorded as infesting the spruce, nor do we know of any record of its food.

Haltica bimarginata (Say).

The Alder Flea-beetle.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ).

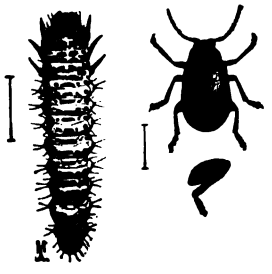

FIG. 40.—The grape-vine flea-beetle, HALTICA CHALYBEA, and its larva.

This devastating devourer, at times, of the foliage of the alder over extended areas, is among the larger of our flea-beetles, being one-fifth of an inch in length. It may be recognized by its general resemblance to the well-known grapevine flea-beetle, *Haltica chalybea* Ill., and its uniform deep prussian blue color with greenish reflections on the head, and the elevated line near the outer border of each wing-cover. A figure of *H. chalybea* is herewith given, which may serve to illustrate its principal features.

It was described by Say, in the *Journal of the Academy of Natural Sciences of Philadelphia*, vol. iv, 1824, p. 85, in the following terms:

Body oblong-oval, blue, minutely punctured; antennæ black; thorax with an impressed, transverse, rectilinear line behind the middle, attaining the lateral margin, and another impressed line before, which is interrupted in the middle and abbreviated each side; elytra with an elevated, submarginal line each side, originating on the humerus, and nearly parallel with the exterior edge.

First Notice of its Injuries.

The first mention that we find of the operations of this insect is that given in the *Entomological Correspondence* of Dr. Harris, 1869, page 267, where, of "Haltica alni Harr. MSS." it is stated:

In traveling from Centre Harbor, N. H., to Conway, on the second of August, 1854, * * * * I saw the alders (*Alnus serrulata*) everywhere ravaged by insects which destroyed the leaves in the manner of canker-worms. Upon examination the spoilers were found not to be all dispersed, and several were seen upon the leaves still continuing their work: at the same time were found in Conway numerous beetles, which proved to be a species of *Haltica*, eating the leaves of the same alders. The larvæ which had ravaged these shrubs were doubtless those of the Haltica before mentioned [*H. alni*].

Its Operations in Maine and New Hampshire.

Dr. A. S. Packard appears next to have noticed the ravages made by this insect in Maine and New Hampshire. As it seems to be only at intervals and in certain localities that these serious demonstrations are made, they are of considerable interest as often as they occur. We therefore copy Dr. Packard's recital, from Bulletin No. 13, Division of Entomology, U. S. Department of Agriculture, 1887, together with his excellent description of the insect:

At Merepoint, near Brunswick, Me., during the middle of August, 1886, we noticed clumps of alders standing in dry soil partly defoliated or with skeletonized, brown or blackish leaves, on which, as well as the still remaining green leaves, were black grubs, sometimes seven or eight on a leaf. All of the alders in the region were not molested, the grubs occurring locally. August fifteenth, we found a single beetle. On placing a number of leaves with the grubs in a tin box, we found a white pupa lying loosely on the bottom of the box, August twentieth; soon more pupæ appeared, and the beetles began to appear in considerable numbers the last week of August. It is evident that in nature the larva falls to the ground to transform, the pupæ entering the earth.

Afterwards, September tenth, we found whole clumps of alders at the base of Iron Mountain, Jackson, N. H., stripped by the grubs, nearly all the riddled, brown, dead leaves having fallen off and thickly covering the ground under the bushes. Such a wholesale devastation of alders we never saw. By this time the beetles had become very abundant, and were apparently feeding on the few leaves still attached to the tree. * * * * * There seems to be a periodicity in the appearance of this beetle, Harris having seen the same grubs in great abundance in the same place in 1854. We have never observed it so common and destructive before in Maine. It is most probable that the beetles hibernate under the leaves, and soon after the leaves expand in May, lay their egg in masses on them, the grubs scarcely stirring from the leaves on which they are born, until ready to pupate. The grubs are probably distasteful to birds, otherwise they would fall an easy prey to them and be kept within due limits.

Larva and Pupa Described.

Larva.— The body is somewhat flattened; head scarcely two-thirds as wide as the body in the middle, black, becoming brown in front near the jaws. Body livid-brown above; the tubercles black; paler beneath, with three pairs of black jointed thoracic legs; no abdominal legs, but an anal prop-leg. The abdominal segments each with a transverse, oval-rounded, ventral, rough space forming a series of creeping tubercles; and in front of each segment is a transverse, oval, crescentic, chitinous area bearing two piliferous tubercles; the back of each segment divided into two ridges, each bearing a row of six sharp tubercles, bearing short hairs; a single ventral row on each side of the ventral plate. Length, 7–10$^{mm.}$ [0.28 to 0.4 inch].

Pupa.—Body rather thick, white. Antennæ passing around the bent knees (femero-tibial joints) of the first and second pairs of legs, the end scarcely going beyond the middle of the body. Elytra with five or six rather deep, longitudinal creases. The salient points of the body armed with piliferous warts. Abdominal tip square at the end, with a stout, black spine projecting from each side. Length, 6$^{mm.}$ [0.24 inch].

The following descriptive notes were made by me of living examples of the larvæ, on July 25, when nearly grown :

Black, fuscous in the incisures, and beneath. Head small, shining, about one-half as broad as the adjoining segment, with some brown hairs. First segment with a glossy black plate (collar) and bordered anteriorly with a few short hairs ; abdominal segments, as seen from above, showing two transverse rows divided by a deep constriction, of six setiferous tubercles — two small ones on each side, the two mesial ones on the front of the segment contiguous or subconnected, forming an elongated spot, and the two posterior ones connected in a shorter spot ; in addition to these is a broad stigmatal tubercle which projects so as to give an angulated form to the segment at this point. Beneath, on each abdominal segment anteriorly, is a roughened ellipsoidal mesial spot, and two smaller ones behind (the creeping tubercles of the Packard description), distant from one another about the length of the front spot, each with two short whitish setæ. Legs long, shining black ; a single terminal proleg. The abdomen tapers uniformly at each extremity.

The excrementa are scrap-like or thread-like, instead of rounded as in many Coleoptera.

Length of larvæ nearly one-half of an inch.

Its Recent Occurrence at Lake Pleasant, N. Y.

When at Lake Pleasant, in Hamilton county, N. Y., almost as soon as my interest in insects became known, it was asked if I had noticed a strange attack on the alders, which had never been observed before,

causing them to look as if a fire had swept over them; and a locality was mentioned where it could be seen.

Visiting the place indicated, near the inlet of Lake Pleasant, on July sixteenth, immense numbers of the dark brown shining larvæ of *Haltica bimarginata* were found on the outskirts of the infested area of alders, rapidly eating away all the green material of the leaves — feeding from both the upper and lower sides, to the number, often, of twelve or more on a single leaf. The area over which the devastating scourge had passed, presented a strange appearance with its completely skeletonized foliage — only here and there an overlooked bit of green leaf being visible on some of the branches near the ground. A closer examination showed beautiful and almost perfect skeletonization of unbroken ribs and branching veins and interconnecting reticular structure, giving almost as attractive specimens for the cabinet as if they had been prepared by hand for ornament or study.

A large number of the larvæ were collected and placed in alcohol, while others were confined in a box, and furnished with leaves for food. They appeared at this time to be about full-grown. Although supplied frequently with fresh leaves of which they partook, they showed scarcely any increase of size, and, much to my surprise, up to the time of my leaving Lake Pleasant — August fifth — none had entered upon their pupal stage.

The Larvæ Destroyed by a Fungus.

The day prior to my departure I visited an infested locality near Round Lake, for the purpose of finding, if possible, the pupæ and its hidden place of pupation. The period of active larval operations had passed, for only one example of the larva could be found still feeding. In that portion of the alder clump where the attack had centered, every leaf had been skeletonized, and apparently more than half of the destroyed foliage had fallen to the ground where it had formed a matted mass of the thickness of an inch or more. In turning over the leaves in search of pupæ, and also on the exposed surface of the debris, many larval remains were noticed showing a fungus attack. The fungus had pervaded the entire larva, covering its surface and enlarging its diameter with a solid white matter, giving to the distorted object much the appearance of the excrementa of some of the smaller birds.

The fungus, from collections made, was identified by the State Botanist, Prof. C. H. Peck, as identical with one that we had in company observed in driving from Elizabethtown, N. Y., to Keene Valley, on August 1, 1877. Very large numbers of dead larvæ were found at

that time, on dead leaves, and on, and under, small stones on the ground beneath alders skirting the roadside that had been skeletonized in the same manner and to the same extent as has been described. The insect was not then determined, but as now recalled, there can be no doubt but that it was *Haltica bimarginata*, operating even more severely and over a more extended territory than as observed the present year.

The fungus was described by the State Botanist as a new species, in the 32*d Report on the N. Y. State Museum of Natural History*, 1879, page 44, under the name of *Sporotrichum larvatum*.

The Pupæ and their Pupation.

None of the pupæ could be found in the alder clump under or among the fallen material, or beneath the stones, or in the ground; but on passing to some large bowlders three or four rods distant, and lifting a thin coating of moss that had accumulated on their top, a few of the pupæ were discovered beneath. On further searching, their regular habitat was disclosed, in the mossy and black vegetable mold margining a large rock partly imbedded in the soil. Hundreds of the pupæ were here brought to light, lying loosely in the mold, without the slightest indication of a cocoon or even a cell, at the depth of about an inch from the surface, and for the most part, about the same distance from the rock. Associated with them were a few of the larvæ which had not yet undergone their change, and also two specimens of the newly transformed beetle. Larvæ, pupæ, and imagines, thus associated, gave evidence of an unusually short period of pupation.

Dr. Packard (*loc. cit.*) has described the pupa as *white*. The description may have been drawn from alcoholic specimens, or from an example that had just undergone its pupation, for of the large number collected by me at this time from their bed of vegetable soil, and on the point of disclosing the imago, all were conspicuously *yellow*.

Pupæ were placed in mold and taken to Albany, where they gave out the beetles from August tenth to seventeenth. From the larval collections made, as before mentioned, hardly any progressed to the pupal state, but died at intervals, after ceasing to feed.

Is it an European Species?

It is probable that *Haltica bimarginata* of Say — the *H. alni* of Harris, may prove to be identical with the *H. alni* Fabr., of Europe. In the Museum of Comparative Zoölogy, at Cambridge, Mass., are examples of the last named insect, in the pupa and imago, which seemed to me (without *H. bimarginata* at hand for comparison) to be the same as our

form. The skeletonizing of the leaves of the alder by the European insect, of which there are also specimens in the Museum in connection with the insects, was apparently, the same as ours.

Has it been Confounded with Haltica chalybea?

Prof. Riley states (in *American Entomologist*, ii, 1870, pp. 327–8, and in the same article reproduced in the 3d Missouri Report, pp. 80–81) that the grapevine flea-beetle, *Haltica chalybea* Ill., "habitually feeds on the alder (*Alnus serrulata*), as well as on the wild and cultivated grapevine," and that it is "apt to be most troublesome where alder abounds in the woods." Is alder a common food-plant of this species, or has the larva of *H. bimarginata* been mistaken for it? The two larvæ resemble one another so closely, that were the figure of *H. chalybea*, given on p. 96, more elongated in proportion to its breadth, it would be an excellent representation, in position and proportionate size of tubercles and in other features, of *H. bimarginata*. This resemblance is not traceable in the figure of the larva given in the Third Missouri Report.

Remedies.

The alder upon which the operations of the beetle have thus far been observed — *Alnus serrulata*, is a very common road-side and field shrub of extensive distribution, and is seldom regarded as of any special value. If from its introduction in clumps in landscape gardening or from employment as hedges, some degree of value may have been given it, attack upon it may readily be checked by spraying the foliage at the commencement of the injury with any of the arsenical poisons or with pyrethrum water.

Crepidodera ruflpes (Linn.).

The Red-footed Flea-Beetle.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

Chrysomela rufipes LINNÆUS: Syst. Nat., ii, 1767, p. 595, No. 65.
Altica rufipes FABR.: Syst. Ent., 1775, p. 114, No. 14; Sp. Ins., i, 1781, p. 135, No. 108; Mant. Ins., i, 1787, p. 77, No. 140.
Crepidodera erythropus MELSHEIMER: in Proc. Acad. Nat. Sci. Phil., iii, 1847, p. 165.
Crepidodera rufipes CROTCH: in Proc. Acad. Nat. Sci. Phil. [xxiv], 1873, p. 71.
Crepidodera rufipes HENSHAW: List Coleop. N. Amer., 1885, p. 112, No. 6979.

An Apple-tree Pest.

This little beetle, belonging to the group of flea-beetles, which embraces those that by means of their stout hind legs, are able to leap to a considerable distance, is a member of the destructive family of *Chrysomelidæ*, or leaf-eaters.

It measures one-tenth of an inch in length, and is of an oblong ovate form. It is shining, with the head, antennæ, thorax and legs, red; the wing-covers are blue, and punctate in lines; the breast and abdomen are black. Its range is given as Middle and Southern States. No differences are apparent between it and the European form.

Examples of the beetle have been sent to me from Coleman's Falls, Va., by Mr. George E. Murrell, where it seems to have developed a habit hitherto unrecorded of it, in feeding upon the buds of apple trees. Mr. Murrell detected its operations during the latter part of May. He has written as follows of it:

Its Injuries to Apple Buds.

The beetles appeared upon my apple trees as the buds began to swell, and beginning with the topmost ones they gradually worked downward, leaving behind them holes that penetrated to the heart of the scion, and having the appearance of being gouged out with a chisel or burned out with a hot wire. The twigs of my bearing orchard were attacked in this manner, and of 650 young trees set out this spring very few escaped; but beyond a loss of symmetry and a foot or two of wood in some cases, they do not now show any serious effects from the attack. In the same field with the young trees just mentioned were several thousand of one year old, set out at the same time, but in nursery rows; but although of the same varieties of, and interspersed with, the injured ones, they entirely escaped injury. I did not observe how long the beetles remained, but noticed that they left during a heavy rain in the latter part of May. I have not heard of the insect in other orchards in my vicinity. My orchards are in narrow mountain valleys inclosed by woods.

Injuries to Leaves by C. Helxines.

This, we believe, is the first time that *Crepidodera rufipes* has been reported as injurious to apple trees, although one of its congeners, resembling it in appearance, *C. Helxines* (Linn.), has been detected by Professor Forbes, State Entomologist of Illinois, in riddling the leaves of apple trees near Normal, Ill. (14th *Rept. Insects of Illinois*, 1885, p. 98). As the last named species — a common and widespread insect both in this country and in Europe — commonly occurs on willows, but is also found not unfrequently on the Lombardy poplar and Balm of Gilead (*Populus dilatata* and *P. balsamifera*), it is to be hoped that neither of the above-named beetles will acquire the habit of feeding on the apple tree, so as to become one of its regular pests.

Another Bud-eating Chrysomelid.

This bud-eating propensity, has recently been displayed by another member of the same sub-tribe of *Halticini* to which *Crepidodera* pertains, which, unfortunately, is one of the most common and broadly

distributed of our leaf pests — the well-known striped cucumber beetle, *Diabrotica vittata* (Fabr.). The pear crop, in portions of California, has suffered severely from its attack, during the spring of 1887. In one locality (Byron) the trees, as reported, swarmed with the beetles, which commenced upon the buds and continued on the blossoms, eating off the bloom, and frequently penetrating into the calyx. The fruit ceased to grow and dropped to the ground. The pear crop was an entire failure, such as had never been known in the locality before. Quinces were also attacked, but not with fatal results. The same beetle also destroyed the almond crop. Later, they attacked the apple trees, but were driven away by bees. (*Pacific Rural Press*, June 11, 1887, xxxiii, p. 527.)

The cucumber beetle had for a long time been known to feed on the blossoms of the apple and other fruit trees, but had not been previously observed in eating into the buds.

Remedies.

In the event of *C. rufipes* developing a propensity for feeding on the buds of the apple, the minute beetles could be poisoned by spraying with Paris green in water — a rather stronger mixture than that used against the codling-moth — at least one pound to 100 gallons of water. Spraying with a strong solution of whale oil soap or tobacco, should render the buds distasteful to it, and it would also serve the purpose of protecting from the apple tree aphis which makes its attack at the time of the putting forth of the buds, and can be more effectively reached at this period than later when the leaves have expanded.

Scolytus rugulosus (Ratzeburg).

The Wrinkled Scolytus.

(Ord. Coleoptera: Fam. Scolytidæ.)

Ratz.: Forstinsecten, 1837, i, p. 187, pl. 10, fig. 10, pl. 11, fig. 4; ib. edit. 2, 1839, p. 230 (as *Eccoptogaster rugulosus* Koch).

LeConte: in Proc. Amer. Philos. Soc., xvii, 1878, p. 626 (introduc. in U. S.).

Riley: in Amer. Entomol., iii, 1880, p. 298 (distribution, etc.).

Penhallow: in Houghton Farm — Diseases of Plants, Series iii, No. 2, 1882, p. 38; ib. No. 3, 1883, p. 63 (operations on peach).

Hagen: in Canad. Entomol., xvi, 1884, p. 162 (literature, habits, etc.).

Henshaw: List Coleop. N. Amer., 1885, p. 149, No. 9153.

Hamilton: in Canad. Entomol., xvii, 1885, p. 48 (variation in color).

Lintner: in Count. Gent., l, 1885, p. 575 (in cherry, peach and plum); in New Eng. Homestead, Sept. 25, 1886.

Atkinson: in Journ. Elisha Mitchell Scientific Soc. for 1885–'6, pp. 74, 75.

SCUDDER: in Canad. Entomol., xviii, 1886, pp. 195–6 (its galleries).
SMITH: in Entomolog. Amer., ii, 1886, p. 127 (food-plants).
BEDEL: in Ann. Soc. Ent. France — Faune Coléop. Bass. Seine, vi, 1888, p. 406 (literature and European distribution).
SCHWARZ: in Proc. Ent. Soc. Wash., ii, 1888, p. 30 (hickory species of Hamilton different).

A Fruit Tree Bark-borer.

This destructive bark-boring beetle, which, since its introduction in this country a few years ago, has made fatal attack on our three principal stone fruit trees, has recently, in accordance with its known European habit, extended its range of operations to apple trees, of which, judging from pieces of the infested wood received from Mr. C. H. Hedges, of Charlottesville, Va., it has already become a serious pest. This is the first instance, it is believed, that its occurrence in apple trees has been recognized in the United States.

From some pieces of apple twigs and branches, and perhaps trunk sections of young trees sent to me in the early winter, about a hundred examples of the beetle were given out during late winter and early spring. They were taken at intervals from the box containing the wood, as follows: On February 23, 1887, 5 examples; on Feb. 25, 13 examp.; on March 3, 16; March 7, 22; March 22, 32; April 4, 10; and on April 23, 1, and the last — 99 in all.

The Larval Burrows.

Removal of the bark from portions of the apple-tree received, showed the sapwood to be furrowed over most of its surface by the burrows of the beetle, sometimes joining or overlapping so that they could not be separately traced. When occurring in the smaller trunks they had apparently commenced in the branches and had extended downward, very gradually increasing in width—at their widest part at the entrance to the hole sunk in the wood for pupation, measuring one-twentieth of an inch. The extent of the longest burrows observed, was apparently two inches; they were so interconnected that no positive measurement could be made. Their general direction was perpendicular to the trunk, but in some instances, for short distances, they ran in a transverse or oblique direction. Figure 41, is from a section of a trunk of a young tree received from Mr. Hedges as above stated.

FIG. 41.—Burrows of SCOLYTUS RUGULOSUS, beneath the back of a young apple-tree.

A section of a cherry tree before me, of two inches diameter, shows still greater destruction of the surface of the sapwood. The burrows are so close that they can not be separated. In a space of one square inch, thirty-two holes made for pupation can be counted.

I have not been able in the specimens of infested wood received, to make out the "mating chamber" of the beetles, or as termed by some writers, "the cradle." They were probably in the lateral branches which had been removed. Dr. Hagen states that "the cradle is perpendicular in most cases except where it begins just below the base of a bud, and is about an inch long." He further adds of the burrows: "The galleries are [*sic.*] to four inches long, and rather deeply injuring the sapwood. The holes for the pupa go deeply, to 4 mm. in the wood" (*loc. cit.*).

Mr. Scudder, in referring to a mine of an European example of *rugulosus* on cherry, in the Museum of Comparative Zoölogy at Cambridge, Mass., states: "The larval mines emerge and diverge from one point of the mating chamber. The main galleries [cradles] are reduced to almost nothing, and the normal mine of this species, as figured by Ratzeburg, shows nothing of the kind" (*loc. cit.*).

Strongly Attacked by Parasites.

Fortunately, the beetle has been met by a strong parasitic attack, which it is hoped will not permit of a great increase of its injuries. From *S. rugulosus* infested wood sent from Virginia on the twenty-third of December, examples of a chalcid emerged two days after its reception, from which it would seem that others may have been disclosed at an earlier date. These were sent to the Division of Entomology at Washington for identification, where they were referred to the Pteromalid genus *Raphitelus*, of uncertain species, but probably *maculatus* — identical with some that had been bred at the Department from the same insect infesting other fruit trees in Ohio and North Carolina.

Later — in January and February — another species of chalcid appeared, characterized by two subquadrate spots on the fore-wing, which Mr. Howard kindly identified as *Chiropachys colon* (Linn.). A third species, obtained more numerously than either of the two preceding, was referable, according to Mr. Howard, to the genus *Eurytoma* — species not ascertained.

Its Injuries to Cherry, Plum, and Peach Trees.

Frequent complaints have been made within the last few years of the injuries of *Scolytus rugulosus* to cherry, plum, and peach trees.

A correspondent from Philadelphia, Pa., has well described its operations in the following note:

A beetle about one-eighth of an inch long, scarcely thick enough to stick a pin through, divided in the middle into two sections [it has an unusually long thorax compared with the length of its abdomen], has killed cherry and peach trees on my place, and now two plum trees, that I had moved last autumn into the chicken-yard to get rid of the curculio, have been destroyed by them. They puncture the trunk and limbs through to the hard wood, here and there, with a bore about the size of a small pin's head. From these wounds the saps exudes and the trees die. Quite large trees are killed by them.

Another correspondent, from near Annapolis, Md., has written of the insect injuries as follows:

I find that they are more abundant than I at first supposed; attacking cherry, plum, apple, and peach. I was going through a peach orchard about two miles distant from my place, where I found that they had killed about a dozen trees and as many more were in a dying condition. I noticed a fine cherry tree failing — leaves beginning to turn yellow and withering, and upon a close examination, I found gum running down the bark in great quantities from the tunnels of these borers. If they increase in numbers as Colorado beetles and many other pests, they will prove the worst enemies that the fruit-growers have to contend with. G. W. D.

Its Introduction and Spread in the United States.

The beetle has probably been brought from Europe within the past fifteen years. It was first discovered at Elmira, N. Y., in an attack upon peach trees, according to Dr. LeConte, who has written of it in 1878 (*loc. cit. sup.*), as follows: "This is a suitable opportunity to notice the introduction of this European species into the United States. I have received specimens from Elmira, N. Y., where it attacks peach trees. According to Ratzeburg, it is rare in Germany, but is found upon plum and apple trees." In 1880, it was reported from Fair Haven, N. J., as destroying all the cherry, peach, and plum trees that had been set out in a particular lot, by boring innumerable holes through the bark, which filled with gum—the death of the trees soon following. A similar attack on cherry trees was reported from Coopersburg, Pa. It had been previously known to infest peach trees in localities as remote as Missouri and Maryland. In 1882, Dr. Hagen found this beetle inhabiting densely large branches of young pear trees that were killed by pear-blight. Although a coccid insect was associated with the beetle it was thought that the branches had been killed by the scolytus and not by the coccid, or by bacteria, believed by some to be the *cause* of pear-blight. In 1885, Mr. John Hamilton, of Allegheny, Pa., announced his

breeding of the insect from hickory twigs (*loc. cit.*). The color of these differed from the ordinary forms. Mr. Scharwz pronounces these examples not *rugulosus*, but probably an undescribed species, to which he has given provisionally, the MS. name of *S. icoriæ*.

Preventive Measures.

No way is known by which a tree once attacked in force by this insect, can be saved. The female lays a large number of eggs in its burrow under the bark, and there are probably two broods a year. The best means of diminishing its numbers and preventing its spread is to take up and burn the infested trees. Where there is danger of attack from the existence of the insect in the vicinity, it may, perhaps, be prevented by applying to the trunk and principal branches of the trees, the wash of carbolic acid and soap which is frequently used, with beneficial results, as a preventive of the apple-tree borer, *Saperda candida*, and the lepidopterous peach-tree borer, *Ægeria exitiosa;* or, as may be still better, the carbolic wash prepared as stated in my 2d Report, p. 24. For directions for preparing the first-named wash, see page 26 of same Report.

Corythuca ciliata (Say).

The Ciliated Tingis.

(Ord. Hemiptera: Subord. Heteroptera: Fam. Tingitidæ.)

Tingis ciliata Say: Descr. N. Sp. Heterop. Hemipt. N. A., 1831; in Trans. N. Y. St. Agricul. Soc. for 1857, xvii, 1858, p. 793; Compl. Writ. Say, i, 1883, p. 349. — Walsh: in Pract. Entomol., ii, 1867, p. 47.— Glover: MS. Notes Journ. — Hemipt., 1876, p. 71 (citation), pl. 8, fig. 4 (*T. hyalina*).

Tingi shyalina Herr.-Sch. — "Fieber, 103, pl. 9, fig. 1." — Packard: Guide Stud. Ins., 1869, p. 552 (on willows).

Corythuca ciliata Uhler: in Cassino's Stand. Nat. Hist., 1884, ii, p. 285; Check-List Hemipt. Heterop. N. A., 1886, p. 22, No. 1053.

Examples of this insect were communicated to me, by Prof. D. S. Martin, of New York city, under date of August eleventh, which had been taken feeding, in their larval, pupal, and perfect stages, on the leaves of the button-wood, or sycamore, *Platanus occidentalis*.

It is quite a common species which has broad distribution over the United States. It was first described by Say in his "Descriptions of New Species of Heteropterous Hemiptera of North America," printed (or in part) in 1831. His description is as follows:

Say's Description of the Species.

Whitish, reticulate with nervures on which are short spines; widely margined; color whitish; thorax with an inflated carina before, extending over the head; sides dilated, bullate, a little elevated, lateral and

anterior margins ciliate with short spines: *scutel* with the lateral margin elevated and an acute, highly elevated carina on the middle: *hemelytra* dilated, with an inflated carina before the middle of each, on which is a brown spot; edge ciliate with short spines, excepting the posterior third and tip, which are unarmed, rectilinear; beneath piceous-black: *feet* pale yellowish.

Length to tip of hemelytra, three-twentieths of an inch.

The larva is spinous, fuscous, with a large yellowish spot each side of the middle, and before the middle a broad yellowish vitta. The species is very common.

Hibernation of the Insect.

But little appears to be known of the natural history of this Hemipteran. One interesting fact therein is, the hibernation of the mature insect under the bark of trees on which it feeds. This appears from examples that were sent to Mr. Walsh for name, from Mr. J. Pettit, C. W., which had been found "in great numbers under the bark of button-wood in the winter" (Walsh, *loc. cit.*).

Compared with C. arcuata.

As closely resembling *C. ciliata*, a figure is herewith given (Figure 42) in illustration, of another common species, *Corythuca arcuata* of Say, which differs from the former in its brown bands and the arquated exterior of the hemelytra. In Figure 43, its eggs are represented on a bit of leaf. They bear so little resemblance to the eggs of insects generally, that their nature would hardly be suspected. In the same figure, an immature form of the insect is shown. They are not at all uncommon on the under side of the leaves of various species of oaks. The illustrations are from Professor Comstock's Report to the Department of Agriculture for 1879, in which an account of this "hawthorn Tingis," so designated from the food-plant on which it occurred, is given. From differences that it shows with typical forms of *C. arcuata*, Mr. Uhler regards it as a variety of that species. For a figure, habits, description, etc., of the more general form, see Cassino's "Standard Natural History," ii, p. 285, fig. 327.

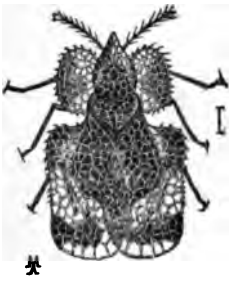

FIG. 42.—CORYTHUCA ARCUATA, from oaks.

FIG. 43.—Eggs and an immature individual of CORYTHUCA ARCUATA.

Dr. Fitch (3d Report, 1859, p. 148) has described *C. juglandis*, occurring on the leaves of the butternut, and differing only in its rectilinear form and spineless veins from *C. arcuata*. Later (*Count. Gent.*, Feb. 14, 1861, p. 114), he has accepted it as probably a mere variety of *arcuata*.

Another Allied Species.

Another form, having much the general appearance of *C. arcuata*, but with a more elevated thorax, was taken by me abundantly, in all stages of development, on the leaves of the chestnut, *Castanea Americana*, at Palenville, N. Y., in August of 1884. Mr. Uhler having seen examples of it, has given it the manuscript name of *Corythuca polygrapha*, while entertaining some doubt of its specific distinctness, from "not yet having had all the links to attach it to the nearly related species." In the vicinity of Baltimore it occurs on oaks.

Injuries of Corythuca.

These harmless-looking insects which Dr. Fitch has compared to "a flake of white froth," are capable of severe injury to the vegetation that they infest. They live on the sap of different plants and trees. According to Glover, one species closely related to *C. arcuata*, has been found on the quince trees in Mississippi and Florida, where the bushes were entirely covered with them, in all the stages of larvæ, pupæ, and perfect insects. Some trees were greatly injured if not entirely destroyed by them. They are said to be able to sting severely when handled (*Report Commis. Agriculture* for 1875, p. 126, fig. 36).

Melanolestes picipes (Herrich-Schæffer).

The Black Corsair.

(Ord. Hemiptera : Subord. Heteroptera : Fam. Reduviidæ.)

Pirates picipes Her.-Sch.: Wanz. Ins., viii, 1848, p. 62, fig. 831.
Pirates picipes. Walsh: in Pract. Entomol., ii, 1867, p. 108.—Wlsh.-Ril.: in Amer. Entomol., i, 1868, p. 87; id., ii, 1870, p. 309.
Pirates picipes. Packard: Guide Stud. Ins., 1869, p. 541, fig. 545.
Melanolestes picipes Stal: Enum. Hemipt., ii, 1872, p. 107, 3.
Melanolestes picipes. Uhler: in Bull. G.-G. Surv. Terr., i, 1876, p. 330; List Hemip. West Miss. Riv., 1876, p. 64; in Cass. Stand. Nat. Hist., ii, 1884, p. 281; Ch.-List Hemip. Heterop. N. A., 1886, p. 25, No. 1236.
Melanolestes picipes. Glover: in Rept. Commis. Agricul. for 1875, p. 130, fig. 42; MS. Notes Journ.—Hemipt., 1876, p. 47, pl. ix, fig. 1.
Melanolestes picipes. Lintner: in Count. Gent., xlix, 1884, p. 877.
Reduvius pungens LeConte; in Proc. Acad. Nat. Sci. Ph., Sept. 1885, p. 404.
Melanolestes picipes. Provancher: Faun. Ent. Can.—Hemipt., 1887, p. 183.

A Stinging Plant-Bug.

A correspondent from Natchez, Miss., has sent the following communication, narrating an occasional demonstration of a species of plant-bug, which has an extensive distribution throughout the United

arm was lost for three days (*American Entomologist*, i, p. 88). Dr. LeConte adds to his description of it: "This insect inflicts a most painful wound. It is remarkable, also, for sucking the blood of mammals, particularly of children. I have known its bite to be followed by very serious consequences, the patient not recovering for nearly a year" (*Proc. Acad. Nat. Sci. Phila.*, 1855, p. 404).

Mr. Uhler has described the insect as a very showy species, of a pitch-brown or black color, with red patches on the sides of the prothorax, spots of the same color at the base and apex of the wing-covers, and bands on the sides of the abdomen. It is rather bald, most of the surface is somewhat wrinkled or rough, and the end of the scutellum is long and sharp-pointed. It measures more than three-fourths of an inch in length, but specimens sometimes occur which are dwarfed to about half an inch. (*Standard Natural History*, ii, p. 280.)

FIG. 46.—CONORHINUS SANGUISUGUS; imago and pupa.

Pirates biguttatus (Say), as it has long been known, but in the recent list of Mr. Uhler has been referred to the genus *Rasahus* Amyot-Serville (from the Hebrew, meaning a "villain")— is also capable of inflicting a severe sting, but will seldom do so except from provocation, as the surroundings under which it is usually found indicates the bed-bug as its principal prey. It evidently delights in human blood, but prefers taking it at second-hand. Under the generic name of *Pirates* it has been commonly known as "the two-spotted corsair," from the two large and conspicuous spots on its elytra, It is shown in Figure 47.

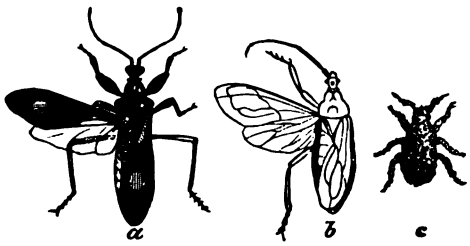

FIG. 47.—*a*, PIRATES BIGUTTATUS; *b*, REDUVIUS PERSONATUS; *c*, its pupa.

Reduvius personatus (Linn.),— recently referred by Mr. Uhler to the genus *Opsicœtus* Klug — shown also in Figure 47, is a common insect often found hanging in spider-webs in dwellings. It also is credited with a special fondness for bed-bugs which it hunts and catches adroitly, while in its larval stage, under the disguise of a covering of dust and dirt completely investing it, as shown at *c* in the figure, and adhering to it by a glutinous secretion. The wounds which it has been known to inflict in its perfect stage with its beak, are said to be very

painful, more so than those of a bee, and to be followed by numbness. Its color is black or dark brown. Its thorax in front is granular or marked transversely with fine striæ. The antennæ are brown and hairy. The eyes are quite large and almost join below. Legs the color of the body, Under side of the body, hairy.

Of *Prionotus cristatus* (Linn.), the "nine-pronged wheel-bug," or the

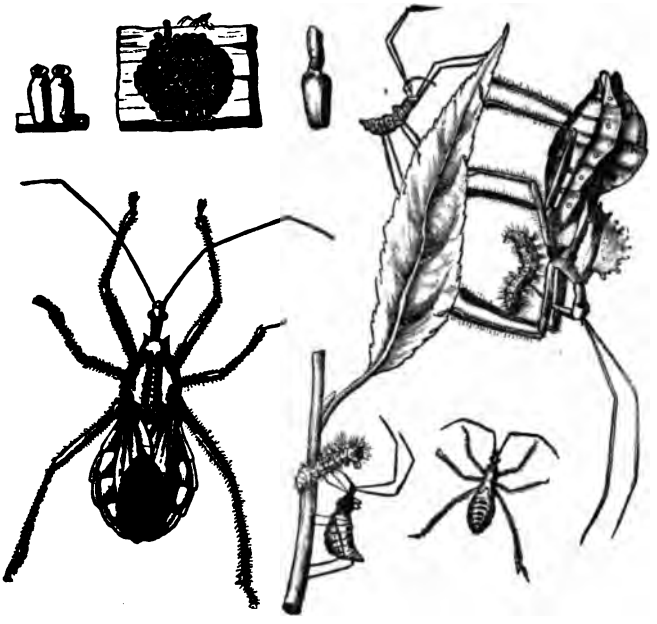

Fig. 48.—The nine-pronged wheel-bug, Prionotus cristatus, in its young and mature forms; also, its hexagonal egg-mass, eggs enlarged to show their flask-shape, and an egg giving out the larva.

"devil's horse," illustrated in figure 48, Glover states that it is very apt to sting if not handled with great care, and that the poison fluid ejected when the wound is inflicted is extremely painful. Having been stung by one of them, "the pain lasted for several hours, and was only alleviated by applications of ammonia. Several days afterwards, the flesh immediately surrounding the puncture was so poisoned that it sloughed off, leaving a small hole in the thumb injured" *MS. Notes Journ.—Hemiptera*, 1876, p. 61–2).

Sirthenea carinata (Fabr.),— of a black ground color, with a long red spot at the base of each wing-cover, the sides of the abdomen also marked with red, and the legs honey-yellow — is also charged with the infliction, at times, of painful wounds, but the authority for the statement can not be found at the present writing.

Dr. LeConte has expressed the opinion that the many relations which we have of spider bites frequently proving fatal, have no doubt arisen from the sting of these insects or others of the same genera. Among the many United States species of *Araneidæ*, he had never seen one capable of inflicting the slightest wound. Ignorant persons might easily mistake one of the *Reduviidæ* for a spider. A physician had sent to him a fragment of a large ant, supposing it to be a spider that came out of his grandchild's head.

It would appear from the foregoing, that a certain degree of caution should always be exercised in the handling of any of the *Reduviidæ*, as the structural peculiarities which render them so formidable to many of the insect world, and so admirably adapted to preying upon them, may readily be directed, under the slightest provocation, to the serious annoyance and injury of man.

Mytilaspis pomorum (Bouché).

The Apple-tree Bark-louse.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. COCCIDÆ.)

Aspidiotus conchiformis Gmel. [not of Gmel.] CURTIS: in Gard. Chron., 1843, p. 735–6.

Aspidiotus pomorum BOUCHÉ: in Ent. Zeit. Stett., xii, 1851, No. 1.

Aspidiotus pomorum. HARRIS: Ins. N. Engl., 1852, p. 220; Ins. Inj. Veg., 1862, p. 252–3.

Coccus pyrus-malus KELLICOTT: in Trans. Cleveland Acad. Sci. for 1854.

Aspidiotus conchiformis Gmel. [not of Gmel.] FITCH: in Trans. N. Y. St. Agricul. Soc., xiii, 1854, pp. 735–742; 1st and 2d Repts. Ins. N. Y., 1856, pp. 31-38; 3d–5th Repts. do., 1859, p. 13.

Aspidiotus juglandis FITCH: 1st and 2d Repts. Ins. N. Y., 1856, p. 35; Trans. *cit.*, p. 739.

Aspidiotus conchiformis. GLOVER: in Rept. Comm. Pat. for 1860 p. 319; in Rept. Comm. Agricul. for 1867, p. 73; id. for 1870, p. 88–9, fig. 57; id. for 1876, p. 43, fig. 49.

Aspidiotus conchiformis. WALSH: in Pract. Entomol., ii, 1866, pp. 31, 47; 1st Ann. Rept. Ins. Ill., 1868, pp. 34–53 (nat. hist., habits, etc.).

Aspidiotus conchiformis. RILEY: in Pract. Entomol., ii, 1867, p. 81; 1st Rept. Ins. Mo., 1869, pp. 7–18, figs. 2, 3; in Amer. Entomol., ii, 1870, p. 213, fig. 132.

Aspidiotus conchiformis. PACKARD: Guide Stud. Ins., 1869, p. 529.

Lepidosaphes conchiformis SHIMER: in Trans. Amer. Ent. Soc., i, 1868, pp. 361–374 (habits, etc.).

Mytilaspis pomorum SIGNORET: in Ann. Soc. Ent. Fr., 1870, p. 98.

Mytilaspis pomorum. LE BARON: 1st Rept. Ins. Ill., 1871, pp. 24–26, figs.

Mytilaspis pomicorticis Riley: 5th Rept. Ins. Mo., 1873, pp. 73–96, figs. 31–34 (extended general account); in Amer. Entomol., iii, 1880, p. 107 (from Alabama); in Bull. 6, U. S. Ent. Comm., 1881, pp. 85, 86 (description); in Scientif. Amer., xlvi, 1882, p. 335, figs.; in Rept. Comm. Agricul. for 1884, p. 353 (distrib. by birds).

Aspidiotus conchiformis. Lintner: in Count. Gent., xlii, 1877, p. 69.

Mytilaspis pomorum. Comstock: in Rept. Comm. Agricul. for 1880, pp. 325, 326, pl. 19, fig. 2 (descr. and food-plants); 2d Rept. Dept. Entomol.—Cornell Univ. Exper. Stat., 1883, pp. 118–121, pl. 2, figs. 5, 5*a*.

Mytilaspis pomorum. Cook, M.: in Rept. Comm. Agricul. for 1881, p. 208 (resistance to insecticides).

Mytilaspis pomorum. Saunders: Ins. Inj. Fruits, 1883, pp. 40–44, figs. 28–34 (nat. hist., remedies, etc.).

Mytilaspis pomorum. Lintner: in Count. Gent., xlviii, 1883, p. 801 (on willows); id. li, 1886, p. 469; id. lii, 1887, p. 321.

Mytilaspis pomorum. Hubbard: Orange Insects, 1885, p. 15, figs. 1, 2 (showing growth of scale).

Mytilaspis pomorum. Packard: Entomol. for Begin., 1888, p. 79 (mention).

A Common and Pernicious Apple Tree Pest.

The scales of this insect upon apple tree bark were sent from Genesee county, N. Y., with the statement of its recent introduction in that vicinity, and the request for information of its nature—how it spreads from tree to tree, whether the infested trees should be destroyed, or if it were possible to arrest the attack.

The scales completely covered the piece of the branch that contained them. Similar examples had been received from time to time, for name and information, from different parts of the State of New York and other States, showing a quite general distribution of this pest of the apple tree—one of the most injurious of the large number that infests it. So common have they become in our orchards, and so destructive to the trees of which they take possession, killing large numbers of them, that they should be known by all of our apple growers.

Its Rapidity of Increase.

When this scale has been allowed to propagate itself for a few successive years without effort made to destroy it, the individuals become crowded together upon the trunk, limbs, and twigs of the tree as thickly as they can place themselves—forcing one another out of position and frequently overlying, and continuing to add to their number so long as they are able to reach with their proboscis the bark and the sap beneath.

A correspondent, writing from Newburgh, N. Y., thus describes the progress of an attack: "Immediately after the fastening of the scale,

the bark beneath becomes diseased, and is ultimately found dead through to the wood. The next season these depredations are repeated, but the new scales are attached between the old ones. On the third year, on trees which are made the special point of attack, the entire bark of the tree is so spotted by the minute dead spots that a general roughness of the bark is noticed, presenting an unhealthy and unsightly appearance in the orchard, and nothing is left to be done but the removal of the trees."

Description of the Scale.

The scales of the female, which are by far the most conspicuous and abundant, are about one-twelfth of an inch long, narrow, and pointed at the apex, rounded at the other extremity and broadest centrally, and ordinarily somewhat curved. This particular form, so much like that of an oyster or mussel shell, was indicated in the specific name of *conchiformis* which it for a long time bore, and under which it was frequently written of in former years, in connection with its then generic reference of *Aspidiotus*, even so recently as during the Reports of Dr. Fitch. Its common name at that time was "the oyster-shell bark-louse"—now it is known as "the apple-tree bark-louse." Its color is brown, or ash-gray, nearly approaching that of the bark, except at the apex, where it bears two of the cast-off coverings of the young insect, which are of a dull yellowish or horn color. The scale of the male is much smaller, nearly straight, and bears but a single molted skin on its apex.

Of the Insect and its Changes.

These scales are not the insect or portions thereof, for the scale-insect may, in its earlier stages, be found beneath them, but are a thin pellicle which has been excreted by the insect for its covering and protection, and thrown out in successive layers, as may be seen under a magnifier, and built up by degrees, very much as is the shell of an oyster.

The several changes that the insect undergoes, from the time of its hatching from the eggs beneath the scale, through its brief period of free and active life, followed by its attachment to the bark where it becomes permanently fixed, its subsequent moltings, the excretion of the scale and its steady growth until it attains its full size, and the mother has placed beneath it a hundred or more minute white eggs—all these form an exceedingly interesting narration, but it has been so often given that the reader who would know the details, is referred to the reports of Harris, Fitch, Walsh, Le Baron, Riley, and others, and the pages of many of our agricultural papers.

Although so much has been written of this common insect, yet there are portions of its history which demand further study, for example, the extent to which it is double-brooded.

Is it Double-brooded in the State of New York?

Prof. J. H. Comstock, in his Report on Scale Insects, contained in his *Report of the Entomologist of the U. S. Department of Agriculture*, for the year 1880, in writing of this insect, which he regards as the *Mytilaspis pomorum* of Bouché, states that "there is but a single generation each year in the north, where the eggs hatch in the latter part of May, or early in June, and two generations in the south."

All of our entomological writers upon the insect have united, I believe, in this opinion, with the exception of Dr. Harris, who has given this as a summary of its life history:

The eggs begin to hatch about the twenty-fifth of May, and finish about the tenth of June. * * * * * * In about ten days the young become stationary, and early in June throw out a quantity of bluish-white down, soon after which their transformations are completed, and the females become fertile, and deposit their eggs. These, it seems, are hatched in the course of the summer, and the young come to their growth and provide for a new brood before the ensuing winter. (*Insects Injurious to Vegetation*, 1862, p. 253.)

Prof. Riley has had the insect reported to him as double-brooded in Wright county, in the southern part of Missouri, and has written further upon this subject, as follows:

In Mississippi I know that there are two generations each year, as I have received the second brood hatching about the first of September. Dr. Harris, years ago, asserted [?, see above, "it seems"] that there were, at least [?] two broods of this apple-tree bark-louse each year, and, though he was evidently in error, so far as his own particular State (Massachusetts) was concerned, and has been severely berated for this statement by subsequent writers, yet it finally appears that his language is not so very wide of the mark. (*Fifth Report on the Insects of Missouri*, 1873, pp. 79–80.)

Not having made special study of this insect at any time, it would not be proper to say that, as a rule, it has two generations a year in the State of New York, and that Dr. Harris was probably correct in his statement regarding it in Massachusetts; but it certainly is double-brooded in New York as far north as Albany *in some seasons*. The following is the evidence upon which this assertion is based:

In a communication made by me to the *Country Gentleman* of February 1, 1877, I stated: "Some terminal twigs of a pear tree growing in a garden in Albany, were recently brought to my notice, upon which the scales of *A. conchiformis* extended to the extreme tip of the new growth of the year. Accompanying these were some pears taken

from the same tree, having on them a number of the scales which had unquestionably been attached to them after the fruit had very nearly, if not entirely, attained its full size."

Upon subsequently visiting the tree, in the garden of Dr. Woolworth, at that time the Secretary of the Board of Regents of the University of the State of New York, it was found (as also others) badly infested with the scale, and the fruit upon it also infested to the extent of readily inviting attention to its condition. No minute was made of the date of this observation, but it was certainly not earlier than the month of September, and may have been in October.

A stem taken from one of the pears, bearing a dozen or more of the scales, was placed in glycerine at the time, and is now in the State collection, subject to verification, if desired.

It must be evident to all who know the habits and development of these insects, that scales found on the mature fruit can only be from a summer brood, and not from that which occurs at about the time of the blossoming of the fruit.

Is Double-brooded in Canada.

At the time of writing the above, I had no knowledge of the scale of this species having been observed on fruit, but the following notice of it has since been published, which shows a double brood for the insect even as far north as in Canada. The authority quoted is, of course, unquestionable. Mr. J. W. Douglass, of Lewisham, England, in a note dated May 12, 1888, upon *Mytilaspis pomorum*, states:

> Mr. James O'Brien has sent to me an apple, just imported from Tasmania, on which were a dozen of the scales of this Coccid, and he says he has seen some on apples from Australia. * * * I have seen the scales of this species on the fruit of apples grown in Britain, yet rarely, and also on American and Canadian fruit. (*The Entomologists' Monthly Magazine*, xxv, 1888, p. 16.)

Remedies.

If a tree has become so infested with the bark-louse that it has extended entirely over it, even planting itself on the terminal twigs, there are but two ways to deal with it: either cut the tree down and burn it, or spray it thoroughly with some liquid that will penetrate the scales and kill the insect or the eggs beneath. This, a proper kerosene oil emulsion, rightly applied, should do. It would better reach the scales when the tree is not in leaf, either in the spring or in the autumn; or if more convenient, it could be attended to in the winter. The oil will readily penetrate the scales and accomplish the desired purpose.

If the tree is small, and the scales not generally distributed over it, they may be scraped off and gathered upon a sheet spread underneath, so that the eggs may all be destroyed instead of being left on the ground to hatch and allow the young to ascend the trunk.

If the scales are confined to the trunk and lower part of the main branches, and a proper spraying apparatus is not accessible, the insects may be killed with a soft-soap solution, provided that it be used at the proper time.

The time of all others when the insect is the most vulnerable is during the early period of its existence — for about a week after hatching from the egg and previous to the time that it has attached itself to the bark and developed its scale-covering. This is usually late in May or the early part of June, and a number of observations have shown it to be contemporaneous with the opening of the apple blossoms. At this time, careful examination will show thousands of the young lice slowly moving over the bark and appearing to the naked eye as little white specks. They are so delicate at this tender age that the friction alone of a stiff brush would kill all the insects with which it came in contact.

Prof. Cook, who has had large experience with this pest, has told the story of just how he has successfully fought it in the orchards of the Michigan State Agricultural College, at Lansing. The account he gives of his method is so decidedly practical that it merits a wide publicity:

> The old remedy, soft soap, or a strong solution of the same, will surely vanquish this enemy if it is applied in early June and again three weeks later. I have proved the efficacy of this treatment over and over again. The trees at once put on new vigor, and in a short time only dead lice are to be found. To apply this specific, I know of no better way than to use a cloth and scrub by hand. To be sure, we can, if dainty, use a brush like a shoe-brush, but I like to go at it with a good cloth, when, with sleeves rolled up, I make pretty sure that no louse escapes.
>
> For the past few years I have added to the soap, crude carbolic acid, which I think improves it, especially if but one application is to be made. I heat to the boiling point one quart of soft soap to two gallons of water, and while still hot, thoroughly stir in one pint of crude carbolic acid. (*Bulletin No.* 14 *of the Agricultural College of Michigan.*

In Saunders' *Insects Injurious to Fruits*, it is recommended that after every effort has been made to destroy the insect while in the scale, in order to complete the work, the hatching should be watched, and while the larvæ are active, the twigs should be brushed with a strong solution of soft soap and washing soda, or syringed with a solution of

washing soda, made by dissolving half a pound or more in a pailful of water.

Painting the twigs and branches with linseed oil has also been recommended and claimed to be harmless to the tree, and effectual for the destruction of the eggs beneath the scales; but we would not commend a resort to this heroic method until experiment shall show the season and the condition of the tree when it may be employed without fear of a harmful result.

Ptyelus lineatus (Linnæus).

The Lined Spittle-hopper.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. CERCOPIDÆ.)

Cicada lineata LINN.: Faun. Suec., 1761, p. 888; Syst. Nat., 1767, pt. ii, p. 709, No. 31.

Cercopis lineata FABR.: Spec. Ins., ii, 1781, p. 330, 8; Mant. Ins., ii, 1787, p. 274, 13.

Ptyelus lineatus UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 243.

Ptyelus lineatus. PACKARD: Entomol. for Beginn., 1888, p. 82, fig. 69.

The Insect abounds on Grass.

The pupæ of this insect were sent, June twenty-first, from Mr. Brooks Strait, of West Stockholm, St. Lawrence Co., New York, with the statement that they were found on the grass of meadows and pastures, and that "this part of the county was filled with them." They were causing considerable anxiety, and many farmers desired to know the amount of harm that they would inflict, and what remedies, if any were needed, might be employed against them.

Answer was made that it was a Hemipterous insect (order embracing the bugs), of the family of *Cercopidæ*, and that it belonged to the group of "spittle-insects," in which the larvæ and pupæ living on the sap of their food-plants, envelop and entirely conceal themselves within a mass of frothy material, sometimes called toad's spittle or frog spittle. The liquid is given out by the insect in quantity so large that portions of it break away from the mass from time to time, and drop to the ground. The group is a large one, embracing many species of the genera of *Aphrophora, Lepyronia, Clastoptera, Ptyelus,*

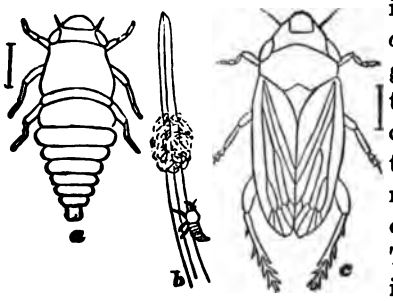

FIG. 49.—Spittle-insect, PTYELUS LINEATUS; enlarged: *a*, larva enlarged; *b*, its natural size on grass with froth-mass or "spittle."

et cet. Common species in the State of New York, are *Aphrophora parallela* Say, *A. Saratogensis* Fitch, and *A. quadrangularis* Say.

Ptyelus lineatus is a common species in low and damp meadows on grasses and some other plants over a large portion of the United States. It has never been known to occur in such numbers, where it is commonly met with, as to cause serious harm to the grasses. The insect matures during the latter part of June, when it becomes winged and feeds for a short time on the sap of the grasses, but its life in this stage is too brief to enable it to be the occasion of greater injury (if so great) than in its earlier stages. It may be recognized, among its allied species, by the narrow brown double streak on the head and prothorax, also by a slender line of the same color near the costal margin of the wing-covers, the margin itself being white (Uhler).

Figure 49, from Dr. Packard's recent publication, entitled "Entomology for Beginners," illustrates the insect in its larval and perfect stages,— their natural size being shown in the lines beside them.

Fabricius has given the habitat of *P. lineatus*, as Germany. It has quite an extended distribution throughout Europe, as well as in this country.

Ephemera natata (Walker).

(Ord. Neuroptera: Fam. Ephemeridæ.)

Palingenia natata Walker: Cat. Neurop. Br. Mus., Part iii, 1853, p. 551, 13.
Ephemera natata Hagen: Synop. Neurop. N. A., 1861, p. 39, 4.

Examples of this May-fly were received on June sixth, from Middleburgh, N. Y., where they had occurred in such immense swarms as to excite general interest, and considerable anxiety lest some injurious effects might follow their appearance. Answer was returned of their entire harmlessness, of their probable source in the Schoharie river at that place, of their brief existence in the winged stage, etc.

The species is a common one, and of broad distribution throughout the northern United States, Dominion of Canada, and Hudson Bay region.

Its general color is blackish. The antennæ are black; the abdomen is striped with two blackish lines; the caudal appendages (setæ) are three in number, of almost equal length, a little shorter than the body, reddish, banded with black; the wings are ash-gray, with black veins and four blackish spots on the front pair, of which the anterior and larger one curves upward to the front margin. The body is 0.6 of an inch long; spread of wings 1.5 inch. The setæ are 0.6 in. long.

Abundance of the May-flies.

The name of "May-fly" has been given to many species of these frail and delicate creatures, in consideration of the month in which a number of them make their appearance in early spring. The *Ephemeridæ* — the name of the family to which they belong — occur in abundance every season in the vicinity of lakes and rivers, but as their flights seldom extend to a great distance, and the time of their appearance may be limited to two or three days, they often escape observation. It is only when they appear in unusual abundance that they attract widespread attention. In the latter part of June, 1880, a species was observed by me, during a few days, at a summer encampment at Lake Bluff, on Sodus bay, Lake Ontario, in such numbers as almost to cover the tents and the surrounding foliage. Upon others of our lakes their dead bodies have been cast up by the waters in windrows on the shore.

Remarkable Occurrences of Ephemeridæ.

Several instances are recorded of their appearance in almost incredible numbers along the rivers in France. One account compares their flight to a snow-storm of the largest flakes, and states that they accumulated on the ground about the feet of the observer to a depth of four inches; eyes, nostrils and mouth were filled by them. At another time they were so abundant at a locality in Carniola, in June, that twenty cart-loads were drawn away for manure.

The summer of 1884, proved to be very favorable for their multiplication in unusual numbers in New York and neighboring states. Their remarkable abundance at different localities in the vicinity of the great lakes, was repeatedly made the occasion of newspaper comment. The following notice from the American Agriculturist, for October, 1884 (page 429), is deserving of record, although not surpassing in its statements a number of other accounts of similar phenomena at other places.

Sand Flies Extraordinary.— We were not a little surprised, on alighting from the carriage at nine o'clock on a last July evening, at the Leland Hotel, Chicago, located close by the lake-shore, to find the air filled with snow-flakes — so it appeared. It was certainly a phenomenon — a snow storm in midsummer! The air was filled with these apparent flakes. The porters were sweeping from the sidewalks around the hotel the two or three inches of gathered "snow." The Brush lights were flickering as if about to go wholly out, submerged by the flakes which were rapidly filling the glass globes surrounding them. One light had already been quite "suffocated," and the globe filled to the top. Rifts of "snow" swept into the passage-ways leading to the rotunda, and the verandas along the lake-side of the hotel, were fairly flecked from one end to the other with the whitening shower. It was indeed a most astonishing sight with the thermometer

at eighty. But a moment, however, sufficed to dispel the illusion. These were not snow flakes which whitened and covered roof and pavement, and suffocated powerful Brush lights, but sand-flies — countless myriads of insects, appearing somewhat like young dragon-flies, coming up like the locusts of Egypt, from the sands of the lake-shore, to harmlessly fly and flutter for a day and die. The next morning, bushels of them (so the head porter informed us) had been swept up during the night and carried away. They lay dead about the rotunda, through the hallways, in the dining-hall and in guests' chambers whose windows had remained open.

The following, recounts a similar phenomenon, at St. Paul, Minn., on July of 1885 :

Chicago, July 15.—A special from St. Paul, Minn., says St. Paul was treated to a phenomenon in the form of clouds of bugs on Wednesday night. About ten o'clock a breeze sprang up from the south, and with it came countless millions of bugs which swarmed around every light, often becoming so thick around the street lamps as to almost obscure the light. Around the electric-light masts they seemed to congregate in greater numbers than elsewhere, and in the vicinity of Bridge square, Seven corners, and at the park at the head of Third street, the streets were literally covered with the pests. Along the Wabash street side of the Second National bank the sidewalk was covered to a depth of over a foot. Around the market house at whatever point an electric light was located, the sidewalk was covered with them. The Merchants' hotel received a liberal share of the bugs, the steps leading to the veranda being completely hidden from sight, and it is estimated that more than a wagon-load of bugs could have been taken from in front of the building. In Rice park was witnessed a curious sight: the trees near electric-lights were covered with bugs, giving the trees the appearance of being moving masses of life, while the electric-light wires were strung with the insects. It is probable that after striking the wire they were unable to get away on account of the current. At two o'clock yesterday morning the streets in the vicinity of Bridge square, which had been cleaned, were again covered with them, and they still continued to come. The bugs are variously called "the green bay bug," "Sunday bug," and "day bug."

A remarkable flight of a minute species of ephemera, has been related to me by Mr. Erastus Corning, Jr., of Albany, as having been witnessed by him at Murray Bay, Province of Quebec, on the St. Lawrence river, N. Lat., 47° 40′, in August of 1888. They came in such numbers that they literally covered every exposed person and object. This was the more extraordinary in consideration of their minute size, which is less than that of some of the Aphides, being only 0.33 inch in expanse of wings. The smallest known ephemerid, *Chloe pygmæa* Hagen, also from the St. Lawrence river in Canada, has 0.24 inch spread of wings.

From examples brought to me, the species has been identified by Dr. Hagen, as *Cœnis nigra*, named by him in the *Proceedings of the*

Entomological Society of Philadelphia, ii, 1863, p. 179, but its description is not yet published. The type specimens came from the upper Wisconsin river.

Early Life of the Ephemera.

Like the "dragon-flies" to which they are related, the ephemera are aquatic in their early stages, swimming about quite actively in the water, in pursuit of food. Some of the species, according to Westwood, are of a more quiet nature, and live in burrows in the mud of the banks, divided internally in two canals, each having a separate opening externally at the extremity, so that the insect can crawl in at one hole and out of the other, without being obliged to make the awkward turn it would have to do in a straight hole.

Their aquatic life may be quite long, even extending to two or three years, during which time, in one genus, they are said to undergo as many as twenty molts.

The Short Life of the Winged Insect.

Their winged life is not limited to a single day, as might be inferred from a popular name sometimes given them, of "day-flies," yet it is much more brief than that of most insects. It is believed that some of the species do not live longer than a day, while others have been kept alive for weeks. Mr. B. D. Walsh has retained living examples of *Hexagenia bilineata* (Say) in his breeding cake for nearly a week* (shown in Figure 50, from an example taken by me in Schenectady, N. Y., in the month of June.) De Geer has kept *Ephemera vespertina* alive for eight days, and Stephens mentions having kept specimens of *Cloeon dipterum* alive for more than three weeks (*Westwood's Introduction*, ii, p. 27).

FIG. 50.—HEXAGENIA BILINEATA (Say).

Their Economic Value, Distribution, etc.

The Ephemeræ have long been noted for furnishing excellent and abundant food for fishes. Swallows and other birds also feed eagerly upon them. They have a broad distribution over the world, from the tropics up to high northern latitudes. Hundreds of species have been described, while a very large number, from the difficulty attending their study, are still awaiting description. Dr. Hagen's *Synopsis of North American Neuroptera*, published in 1861, contains forty-five North American species.

* *Practical Entomologist*, ii, 1867, p. 95.

Hairsnakes as Parasitic on Insects.

The Gordiacæa are so frequently encountered in the form of internal parasites of insects, that a brief notice of their character may be acceptable to the entomologist, as well as to the general naturalist.

The Superstition Regarding Hairsnakes.

A prevalent superstition respecting the strange looking creatures known as "hairsnakes," and when of smaller size, "hairworms," is that they are produced from horse-hairs which had found their way into ponds, pools, barrels of rain-water, etc. It should not be necessary to state that such a transformation is an utter impossibility, and that no dead organic matter can ever be thus changed into a living creature. It is a law of nature that every animal being, from the lowest to the highest, has its commencement in an egg.

What Hairworms Are.

The hairworms, of which there are a number of species known, belong to the *Entozoa* (of the class of worms — *Vermes*), which embraces a large number of small, worm-like animals (the tapeworm might with propriety be termed a large one) that pass a portion of their existence within the bodies of other animals as parasites. There are two genera of the hairworms, viz.: *Gordius* and *Mermis*, which

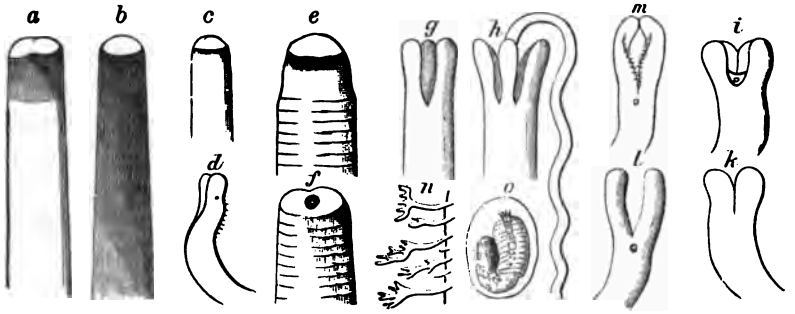

Fig. 51.— *a*, *b*, Anterior ends of female and male Gordius varius; *c*, *d*, fore and hind ends of Gordius linearis; *e*, *f*, same of Gordius robustus; *g*, hind end of Gordius varius; *h*, the same, with its three lobes more divergent, and exhibiting the extrusion of its cord of eggs; *i* and *k*, the same (two-lobed) of the male; *l*, the posterior end of the male of Gordius longolobatus; *m*, the same of the male G. linearis; *n*, portion of the fringe of the latter, highly magnified; *o*, egg of G. varius containing a fully developed embryo. (After Leidy.)

differ somewhat in structure, and ordinarily in color, the former being brown or black, and the latter white or pale yellow. They vary greatly in length as they occur to us, partly from their age, but also from their difference in species, some measuring but four inches, and the longest recorded, twenty-six inches. Their general hair-like appearance, is well-known. Their structure is apparently the same

throughout, with no particular features by which the head can be distinguished from the tail by the ordinary observer — indeed by some writers the two have been confounded, even when studied microscopically. Figure 51, from a paper by Dr. Leidy, in the *American Entomologist* for May, 1870, presents enlargements under a high power of the extremities of different species of Gordius, and shows marked differences and well-defined specific characters therein.

The Gordiacæa are not rare, but are from time to time met with in turning over damp soil, perhaps in a little knot of several individuals twisted together (whence we may have the "Gordian knot"), in barrels of water, in ditches, wagon-ruts, ponds, pools, drinking troughs, wells, etc. They are sometimes discharged from water-pipes, as in the instance of a Gordius of about six inches in length, which was brought to me by a lady who had detected it in a glass of water drawn from a faucet, by the slight tingling sensation which it produced upon her lips as she was about to drink in the dark.

A Common Parasite of Insects.

As a parasite, *Gordius* occurs in the bodies of insects of nearly all the orders, as Hymenoptera, Lepidoptera, Coleoptera, Diptera and Orthoptera. Of the latter order, it is often found in katydids, crickets, cockroaches and grasshoppers — sometimes as many as five in a single grasshopper. They are met with in their parasitic stage by dissection of the insect, its accidental crushing, or in a voluntary escape when the time has come for their free existence: they have frequently been seen emerging from the heads of grasshoppers.

Some of the Characteristics of Gordius.

The Gordius is a peculiarly constructed creature: microscopic examination reveals what may be a mouth, but it seems to possess no stomach, intestinal canal, or vent. Its interior is wholly occupied by a white matter resembling the pith of a plant. Its nutrition is suggestive of that of the rootlets of plants; yet it is known to have generative organs, a nervous system, etc. It is wonderfully prolific. It eggs have been seen to be extruded in a delicate thread or cord (as at *h* in the figure) of an entire length of nearly eight feet, containing as estimated from a small section, nearly seven millions of eggs.

Its Life-History.

A brief summary of the life-history of the Gordius is as follows: Its appearance while still in the egg, is shown at *o*, in Figure 51. After emerging from the egg, it presents the successive appearances given at *p*, *q*, *r*, in Figure 52. In its earliest, or embryo stage, it lives in water. Floating about until it comes in contact with some aquatic

larva, as of a species of fly or other insect, it usually enters the body through the joints of the legs, and becomes encysted, or inclosed in a small sac or bladder, as are the Trichinæ. When these larvæ are eaten by fish the cyst is broken and the Gordius passes to its second stage. After having remained free in the body for a while, it again becomes encysted in the mucous layer of the intestines. In its third stage it is again free, when it penetrates into the intestines of the fish, whence it passes with the fæces into the water, where it enters upon its final growth, undergoing other changes. Such is its history when entering into aquatic larvæ, as elaborated a few years ago by M. A. Villot, a French scientist. Its subsequent changes, when parasitic upon terrestrial insects have not been as fully observed, and just how, at maturity, it succeeds in entering their bodies, is still a mystery.

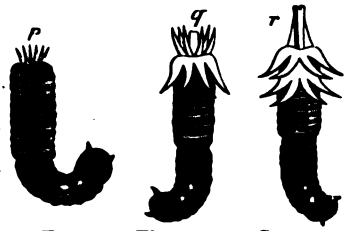

Fig. 52. — The young Gordius varius, after emerging from the egg, showing different degrees of protrusion of the oral apparatus. (After Leidy.)

Mermis Parasitic on the Apple-worm.

The other genus of hairworms, *Mermis*, has occasionally been found within apples, where it occurs as a parasite of the apple-worm, the larva of the codling moth, *Carpocapsa pomonella*. A notice of *Mermis acuminata* occurring in some apples in Orange county, N. Y., in 1875, coiled up in the fleshy part of the fruit, about midway between the skin and the core, was given by me in the *Thirtieth Annual Report on the N. Y. State Museum of Natural History* for the year 1879 (pp. 117–126); also in my *Entomological Contributions* (No. iv, pp. 5–14). It is therein mentioned that a species of *Mermis* infests the *Carpocapsa pomonella* larva, in Europe. According to Dr. Speyer, the *Gordiacœa* not unfrequently occur in larvæ which feed on tall trees, as well as those which live on plants and shrubs. Wet seasons seem to be productive of the parasitism, and Dr. Speyer recalls a number of years ago, his having met with several of such instances. From an example of *Hadena adusta*, he had a *Mermis* emerge of the length of eight and a half inches, and another from *Hesperia lineola* after it had been pinned. Prof. von Siebold suggests that a heavy dew may so moisten the trunks of trees as to enable the *Mermis* to ascend them.

Those who would know more of these interesting creatures, may find an excellent extended article upon them in the *First Report of the U. S. Entomological Commission*, 1878, pp. 326–333, from which the illustrations herewith presented have been taken.

Cermatia forceps (Rafin.).

(Class MYRIAPODA: Ord. CHILOPODA: Fam. SCUTIGERIDÆ.)

Calista forceps RAFINESQUE: in Annals of Nature, 1st No., 1820, p. 7.
Cermatia coleoptrata VILLIERS. SAY: in Journ. Acad. Nat. Sci. Phil., ii, 1821, p. 109; Compl. Writ., LeConte Edit., ii, 1883, p. 29.
Cermatia Floridana NEWPORT: in Linn. Trans., xix, 1845, p. 353.
Scutigera Floridana GERVAIS: Aptera, iv, p. 225.
Cermatia forceps. WOOD: in Journ. Acad. Nat. Sci. Phil., 2d ser., v, 1862, p. 9; in Trans. Amer. Philosoph. Soc., new ser., xiii, 1869, p. 145, pl. 3, figs. 1, 1a.
Cermatia forceps. PACKARD: Guide Stud. Ins., 1869, p. 673; in Amer. Nat., xiii, 1879, p. 527; in id., xiv, 1880, pp. 602, 603 (eyes and brain).
Cermatia forceps. HENSHAW: in Amer. Nat., xiii, 1879, p. 711.
Cermatia forceps. MURRAY: Econom. Entomol.—Aptera, p. 29.
Cermatia forceps. LINTNER: in Count. Gent., xlv, 1880, p. 311; in Brooklyn Citizen, Sept. 5, 1887, p. 3, c. 5, 6.
Cermatia forceps. UNDERWOOD: in Entomolog. Amer., i, 1885, p. 149.
Scutigera forceps. BOLLMAN: in Entomolog. Amer., iv, 1888, p. 8.

Examples of this denizen of many Albany dwellings, have so frequently been brought to this office for name, etc., that it is believed that an account of it will prove of general interest, since its annoying intrusion is by no means limited to Albany, but is co-extensive with an already extended distribution over the Northern United States.

Does not Belong to the Class of Insects.

Its consideration does not properly come within the province of an entomological department, as it is not a member of the class of insects — characterized by having only six legs in the perfect stage, and from eight to twenty-two in the larval state, but of that of the Myriapoda, members of which are popularly known as "thousand legged worms," centipedes, etc. Among these it holds high rank — almost the highest, and it consequently approaches near to the insects in several respects, as in the character of its head, its long antennæ, the small number of its abdominal joints, and other structural features.

Is One of the Centipedes.

It may claim more than an ordinary share of interest, from its being a veritable Centiped, and from the determination that it displays of domesticating itself in our northern homes, which have hitherto been free from the intrusion of this class of unwelcome guests — so common and so seriously annoying in warmer climates. The anxiety that it has already aroused is shown by the frequent requests that are being made for some information of its nature and of its habits — whether harmful, dangerous, or otherwise.

Description.

It is about one inch in length of body: some southern individuals have measured one inch and a fourth. Its breadth at the widest part is about one-sixth of an inch. Its general color is a light olive-brown. The head is large, broader than the contiguous rings of the body, of an oval flattened outline, and is marked with two converging black lines on its front. The antennæ are quite long, many-jointed, attenuated, being thread-like at the end. The eyes are black, large, prominent, and compound; beneath them is a pair of spined palpi; and back of these, on the hinder part of the head, a pair of leg-like pointed jaws, ending in a black tip. The head and its appendages are shown in enlargement in Figure 53, in which an excellent representation of the creature is given.

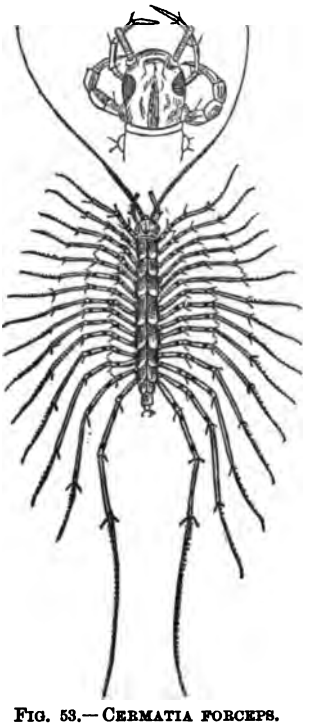

Fig. 53.— Cermatia forceps. (After Wood.)

The body has its sides nearly parallel, being but a little broader at its middle. It is traversed centrally upon the back by a sharply defined black line which commences on the head between the eyes and terminates at the last abdominal joint. Upon each side of this is a similar well-defined black line, commencing at the eyes and continuing over the entire body. The upper side of the body shows eight plates or shields, which are suboval in general outline, sharply excavated posteriorly, and thin and reflexed at the sides: under a magnifier these show granulations or spines. Underneath, the body shows fifteen rings, two of which are covered by each of the dorsal shields except the last.

There are fifteen pairs of long legs, armed with several toothed ribs, and with spines at the end of the joints. The two principal joints (tibia and tarsus) have each two incomplete black bands. The ends of the legs (metatarsal joints) are many-jointed, long, round and terminated in a short, black, acute hook. The front legs are about two-thirds the length of the body. The following ones increase in length to the terminal pair — the latter, longer than the body (in the male one-fourth longer, in the female twice as long).

Its Distribution.

It is a southern form, which seems for some time past to have been steadily extending its way northward. Say, who cites the species in his *American Entomology*, in 1871, under the name of *Cermatia coleoptrata*, gives it as an inhabitant of the Southern States, which he had observed in Georgia and Florida. The examples described by Newport as *Cermatia Floridana*, were from East Florida, where it was quite common, running about in houses at night. The examples deposited in the Smithsonian Institution at Washington are, according to Dr. Wood, author of the *Myriopoda of North America*, from Tamaulipas in Mexico, St. Louis, and Washington.

It first came under my observation in Albany, in the year 1870, in a specimen brought to the N. Y. State Museum of Natural History, which had been taken in this city. It had been observed within the State at an earlier date, for Dr. H. A. Hagen informs me that a living specimen was seen by him in his bed-room at the Prescott House, in New York, in October, 1867 — the first articulate to greet him upon his arrival in America.

In 1878, Dr. A. S. Packard found an individual hidden in some wrapping paper in his house at Providence, R. I., which he thought may have been brought in a bundle from New Jersey, as it had not, so far as he knew, been known previously to exist north of Philadelphia. Its capture was made the occasion of its notice as "A Poisonous Centipede," in the *American Naturalist* for August, 1879. The publication of this notice brought forth a note from Mr. Samuel Henshaw, of the Boston Society of Natural History, to the effect that the society's collections contained six examples taken in Massachusetts, and that three others were known to have been captured in other parts of the State. It had also been taken at Milford, in New Hampshire.

In a recently published paper entitled, *The North American Myriapoda*, by Prof. L. M. Underwood,* of the Syracuse University, it is given as having been observed by the writer at Bloomington, Ill., Philadelphia, Pa., Brooklyn, N. Y. (somewhat common in cellars), and at Utica, N. Y. (in a single example, running about the floors of the N. Y. Central Rail Road Station); and as somewhat generally distributed east of the Mississippi river.

In a *Preliminary List of the Myriapoda of Arkansas*, by Charles H. Bollman,† it is recorded as occasional in that State; "one adult was seen at Arkadelphia, and several young at Little Rock."

* *Entomologica Americana*, i, 1885, pp. 141-151. † Id., iv, 1888, pp. 1-8.

Its Abundance in Albany, N. Y.

In a communication made by me to the *Country Gentleman*, in 1880, it was stated that "probably as many as fifty examples have come under my observation during the ten years that had elapsed since the first notice of it here." During the subsequent seven years, it has continued to increase steadily in number. It has been frequently brought to me from residents of various parts of the city, as something observed for the first time in a single example; and numerous inquiries have been made of its habits, whether or not it was a new depredator on carpets or clothing, to be added to the clothes-moth and carpet-beetle, or if it was in any way injurious, as it was occurring in such numbers as to entitle it to be ranked as a household pest. In one instance, in the pulling down of an old wooden building in Hudson avenue, a multitude of them were discovered in removing the wainscotting of the basement floor.

Its Habitat.

It has usually been reported from basements, and it is, perhaps, more frequently seen in the vicinity of the hot-water pipes — the favorite haunt of another pest of many city homes, viz., the Croton bug, *Ectobia Germanica*. It is not limited, however, to this portion of dwellings, for its long, flexible, and agile legs, in its travels for food, serve for its distribution through all the apartments. It has been seen scurrying over the parlor carpets, and while this notice is being written, it has been brought to me from the third floor of a dwelling, where it was found quietly resting upon a damp piece of linen cloth hung up for drying.

A young individual, the extended length of which was less than three-fourths of an inch (body 0.18 in., antennæ 0.33 in., hind legs 0.21 in.), was taken February second from the water of an aquarium in my office, on the fourth floor of the Capitol.

What are its Habits.

It will be a relief (in one direction, at least) to know, in consideration of its multiplication as a household pest, that the new-comer will not eat carpets, or clothing, or manufactured fabrics of any kind; nor does it emulate the roach and the Croton-bug in their attack and defilement of various articles of domestic food. Its structure has made it carnivorous, and it is believed to subsist, after the manner of its allies, upon other living creatures which its rapid movements enable it easily to catch. For this purpose, it has been provided with peculiar jaws for grasping and holding, which are probably channelled for the injection of a poisonous fluid into the body of its

captives. These have been characterized as "something half-leg, half-jaw, after the fashion of the falces of spiders, with a sharp point and a hollow duct up their core, which is connected with a poison gland, as in the spider."

The Cermatians, to which this species belongs, and of which there is but one other species known in the United States, viz., *Cermatia Linceci*, from Texas (these two have the honor of constituting the family of *Scutigeridæ*), are said to be very rapacious and carnivorous in their nature, springing upon their prey after the manner of some of the spiders. Dr. Wood has written of the order to which the above family pertains (*Chilopoda*), which embraces also the poisonous centipedes of the Southern States, known in science as *Scolopendridæ*, as follows: "The whole organization of the Chilopods fits them for their predatory and carnivorous habits. The distinctness of the segments, which are not closely approximate, and the flexibility of the segments themselves, enable them to move their body in every conceivable direction. Their highly organized nervous and muscular system, and the length and power of their legs, betoken habits of great activity; whilst the formidable nature of their mandibles, and the sharp spines, both lateral and terminal, with which their feet are armed, fit them for predatory warfare."

Its Food.

We have yet to learn what are the living creatures that the Cermatia finds within our homes for its prey, and which it could not as well or better obtain elsewhere. Possibly with this knowledge acquired, we might receive it as a welcome guest whenever it appears, in the confidence that it would not obtrude except for the purpose of relieving us from greater pests. Some writer has credited it with feeding on roaches and croton-bugs, but this may be a mere supposition. In experiments made by me to test it with the latter, by confining the two together, the bugs have not been eaten, and the Cermatia has been the first to die. Perhaps it preys upon these insects only in their younger stages; or its disposition may be changed under confinement, to which it shows itself to be remarkably sensitive, for upon all the occasions when it has been brought to me alive, even when placed under a glass cover of a half-bushel capacity, it has invariable died within two days. Can it be that it succumbs so quickly to want of its proper food, or to need of moisture? The ordinary Myriapods, of the family of *Julidæ*, or "hundred-legged worms," such as are found in decaying vegetation, fruit, etc., have survived for weeks in my office, although crowded in small glass *phials*, almost excluded from air and entirely without food.

The bed-bug is known to have inveterate foes in two or three other members of its own order, the Hemiptera. *Reduvius personatus* (Linn.) and *Pirates biguttatus* (Say), two insects resembling the well-known squash-bug, as shown in figure 47 of page 112, feed eagerly upon it,—the former, while in its pupal state, completely enveloping itself in a mask of dust and dirt for its better concealment while lying in wait for its prey. Of another member of the bug order, *Pentatoma bidens*, it is reported that six or eight of them, shut up in a room swarming with bed-bugs, completely exterminated them in the course of a few weeks. The Cermatia, if so inclined, would prove an expert hunter of this pest: may further observations show it to be so.

Of other food that our houses might furnish, may be mentioned these: The little red ant, flies, the larva of the carpet-beetle (the clothes-moth would not be sufficiently abundant), and spiders. It will be of interest to note if any of the above-named creatures diminish or disappear when the Cermatia domesticates itself.

Is it Poisonous?

It is undoubtedly poisonous, but not to an extent that it need be the occasion of any alarm. The mosquito, when it thrusts its beak, composed of six distinct pieces, into our flesh, and draws thence the blood through the channel that they form, is supposed to instil into the wound at the same time a venomous liquid, which causes the blood to flow more freely, and occasions the subsequent irritation, so different from that resulting from the prick of a pin or needle. Spiders—house-spiders as well as others—are poisonous, and kill their prey, upon the juices of which they afterward feed, by injecting poison in them. Their mandibles are constructed after the manner of the rattlesnake's fang, the aperture for the discharge of the venom being, like that, placed on the outer curve of the mandible, and communicating through a duct with a poison sac at its base. And yet they seldom excite fear or terror, nor should they do so, for their fangs are only used on other insects that they may procure their food, or in self-defense, if molested and unable to escape. No one likes to kill a spider.

Wood states of the Chilopoda, to which Cermatia belongs: "There can be no doubt but that they are provided with poison glands, situated at the base of the mandibular teeth, and perhaps also at the bases of the terminal claws of the feet." Newport has observed in *Scolopendra* the longitudinal opening at the inner margin of the apex of the mandible communicating with a poison sac, and the gland of which it is the reservoir. Latreille, from observations on *Cermatia araneoides*

of the south of France, satisfied himself of the poisonous nature of the bite of a Cermatian.

The above authorities fully attest the poisonous character of this creature, and it has also been confirmed by other writers, who might be cited. There is no record, however, of its bite ever having been inflicted upon a human being. In one instance brought to my knowledge, harm from it was surmised. A young lady pupil, occupying a dormitory of a boarding-school, discovered on her person, on awakening, a hard, swollen, inflamed and somewhat painful spot of a considerable size. While speculating on its cause, she saw one of these Cermatians resting on the sloping ceiling directly over her bed. Had it inflicted a bite during the night under the provocation of sudden pressure, or was its presence at the time merely accidental?

Life-History.

Of this, nothing appears to be recorded by our writers, and I have no access, at present, to whatever may have been written of other species of the genus occurring in Europe or elsewhere, of which Newport, in his monograph on the Myriapoda, in 1845, has recorded and described seventeen species.

From the observation given in a preceding page of this paper, it appears that the young (quite small) are to be found in the month of January. Adult forms have been brought to me, as from records at hand, in April, June, October, November and December, and they are probably to be found during every month of the year. A young individual, about one-third grown, has been taken by Mr. Erastus Corning, Jr., on September twenty-ninth, and contributed to the collections.

This creature is apparently quite cleanly in its habits, as it has, on different occasions been observed in the laborious and time-taking operation of cleaning its many legs by passing one after another, from their extreme base to the tip, through its mandibles.

Remedy.

If the Cermatia should be found to occur in large and annoying numbers in particular localities, it could readily be disposed of by a free application to the premises of fresh pyrethrum powder.

BRIEF NOTES ON VARIOUS INSECTS.

? DOLERUS sp.—The saw-fly larva, noticed in my report to the Regents for 1886 (*40th Rept. N. Y. St. Museum Nat. Hist.*, pp. 87–90), as cutting off the heads of wheat in New Jersey and Pennsylvania, was again reported by Mr. J. E. Wittmer, of Hale, York county, Pa., as having made its appearance, June 16, 1887, but at that time, in no increase in number or injury over that of the preceding year. No examples were obtained for further study.

The same species, evidently, was the occasion of remark and discussion, at the Annual Meeting of the New Jersey State Board of Agriculture, at Camden, in January of 1888.

Mr. Denire stated, that the insect, the preceding year, about two or three weeks before harvest, had cut off the heads of the wheat, about half an inch below the head. In his own field, and in others in his neighborhood, about five per cent of the crop had been thus destroyed.

Mr. Nicholson remarked that a number of complaints of this injury had been received from Monmouth county. The worm, in some cases, had destroyed about twenty per cent of the crop, by cutting off the straw an inch or two from the head, a short time before harvest, and it was impossible to gather it with any machinery on the farm, for the heads fell and were lost on the ground. (*Fifteenth Annual Report of the New Jersey State Board of Agriculture*, 1888, page 164.)

DANAIS ARCHIPPUS (*Fabr.*).—The larvæ of this butterfly were observed at Sageville (Lake Pleasant), Hamilton county, N. Y., July eighteenth, on milkweed (*Asclepias*), in various degrees of development, from its first stage (previous to its first molt) to near its full growth. The following memoranda were made of it:

As observed in its first stage, in readiness for its first molt, July twentieth, it is nearly one-fourth of an inch in length. The two black horns on the second segment are subcylindrical, about one-fourth the diameter of the body in length. The two black tubercles on top of the eleventh segment are less than one-half so long. The bands traversing the body are black on a white ground, on the middle of each segment, with yellow between, over the incisures. The head is shining black, with two brown lines on each side.

In the second stage, the front horns are straight, transversely wrinkled, moderately tapering, with a length about equal to the breadth of the body. The horns of the eleventh segment are about one-fourth as long as the anterior ones. Head, with the lateral perpendicular lines yellow, and with a yellow triangular spot centrally in front.

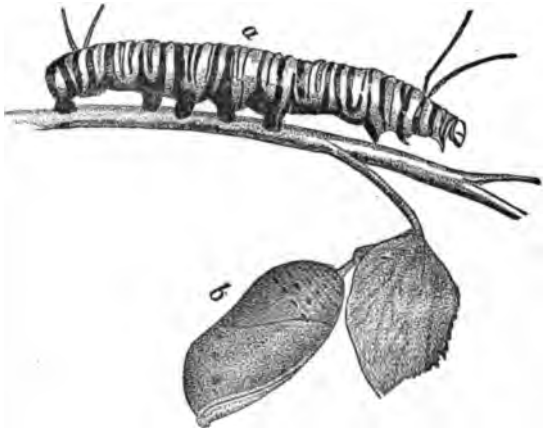

FIG. 54. — DANAIS ARCHIPPUS: larva and chrysalis. (After Emmons.)

In the third stage, in readiness for molting, the anterior horns are curved, and have a length equal to the breadth of the body, and are twice as long as the posterior ones. No notes were made of the above features in the subsequent stages. The mature larva is represented in Figure 54.

A larva suspended for pupation on July nineteenth, and pupated on the following day. Its chrysalis is shown at *b* in the figure.

The presence of the young larvæ on the leaves may readily be detected, even when they are so small as to escape ordinary observation, through a knowledge of its habit of feeding at this stage. It probably first consumes the shell from which it emerged, as no remains of it were seen. Then, without leaving its position, and, adhering by its hinder legs, it eats through the tender leaf, and continues to feed, by simply bending its body to either side, in a large portion of a circle of less than one-fourth of an inch in diameter. Examination of the leaves will often show a crescentic hole, unmistakably the work of the larva, and, usually, its presence on its feeding ground, just within the crescent.

The following species of butterflies were observed at Sageville, Lake Pleasant (southern portion of the Adirondack region, height above tide of about 1,800 feet), during the three weeks from July sixteenth to August fifth. Some species were possibly overlooked, as no special attention was given to them — the locality not offering rare forms:

Papilio Asterias *Fabr.*
P. Turnus *Linn.*
Pieris oleracea (*Harris*) form æstiva.
P. rapæ (*Linn.*).
Colias Philodice *Godt.*
Danais Archippus (*Fabr.*).
Argynnis Cybele *Fabr.*
A. Aphrodite *Fabr.*

Argynnis Atlantis *Edw.*
A. Myrina (*Cramer*).
A. Bellona *Fabr.*
Phyciodes Tharos (*Drury*).
Grapta Faunus *Edw.* — very common.
G. comma (*Harr.*) form Dryas.
Grapta Progne (*Cramer*).
G. J. album (*Bd.-Lec.*).
Vanessa Antiopa (*Linn.*).
V. Milbertii *Godt.*
Pyrameis Atalanta (*Linn.*).
Limenitis Arthemis (*Drury*).
L. disippus (*Godt.*).
Satyrus Alope (*Fabr.*).
Feniseca Tarquinius (*Fabr.*).
Chrysophanus hypophleas *Bd.*
Lycæna Comyntas (*Godt.*).
Pamphilus Peckius (*Kirby*).
P. Metacomet (*Harris*).
Total, 27 species.

Thecla strigosa *Harris.*— A larva of this beautiful butterfly was received on June eighth, from E. Moody & Sons, of the Niagara Nurseries at Lockport, N. Y., which had burrowed into a cultivated plum and eaten out its interior after the manner of *Thecla Henrici*, in the wild plum, as described by Mr. W. H. Edwards, in *Papilio*, i, p. 151–2. It was seen to differ from that species, as it was of an uniform green color, and lacked the tuberculous dorsal ridges characterizing that form. At the request of Mr. S. H. Scudder, it was sent to him for figuring. Not reaching its destination in a healthful state, it was preserved by inflation, after it had been compared with two other examples in the possession of Mr. Scudder, which were feeding on the leaves of shad-bush (*Amelanchier*) and blueberry (*Vaccinium*), and found to agree with them "to the uttermost microscopic detail." Subsequently these examples gave *Thecla strigosa* Harris.

The note of "the larva of *Thecla Irus* Godt., burrowing in a plum," which appears in the Report of the State Entomologist to the Regents of the University S. N. Y. for the year 1886, in the *Fortieth Report of the N. Y. State Museum of Natural History*, page 140, refers to the example above noticed, and should have been so recorded: hence the above particulars.

*Nisoniades Persius *Scudder.*— Four examples of this very common Hesperian butterfly in the State of New York (two males and two females) were identified by me among the collections made by Dr. H. A. Hagen in the Northern Trans-Continental Survey in 1880, at Yakami river, La Chapples, July 16; Yakami city, July 2, and [label not legible] July 11th.

*Sphinx Canadensis *Boisd.*— An example of this rare Sphinx (the *S. plota* of Strecker) was captured at light, on a window, at Tannersville, Catskill mountains, N. Y., on August 13th, and is now in the collection of Mr. W. W. Hill, of Albany.

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*The notes thus marked on this page and following ones, are from the preceding report to the Regents (for 1885) of which no copies have been printed except the regular edition of the Annual Report on the N. Y. State Museum of Natural History.

Mr. William Gray, of Kenwood, informs me that four examples of the species (one of which is in the collection of Hon. Erastus Corning, of Albany) were taken by Dr. James S. Bailey, upon the skin of a deer hung up to dry, in the Adirondack mountains. The species would seem, from the above collections, to favor high elevations.

*MELITTIA CUCURBITÆ (*Harris*).— The following memoranda on the squash-vine borer have been kindly furnished me by Mr. J. P. Devol, of Petersburg, Va., in consideration of a published request for information upon the life-history of the species:

June 24th, found two vines of Boston marrowfats dying, from which the borers had escaped and entered the ground.

July 3d, dug up a larva from two and a half inches beneath the surface of the ground, at about two inches from the root-stalk.

July 8th, a larva found in a leaf-stalk, two feet distant from the stalk.

HYPPA XYLINOIDES *Guenée.*— A caterpillar, which proved when the moth was disclosed on July twelfth after a probable pupation of twelve days, to be this species, was taken June twenty-eighth, feeding on the leaves of raspberry. It attained a length of one inch and one-fourth. It was of a rich brown color throughout, and in shape, regularly increasing in size from its front to its eleventh segment, recalling the form of *Amphipyra pyramidoides*. After feeding heartily in confinement, mostly at night, on leaves furnished it, it spun up among some leaves in the box, as if this was its ordinary habit.

EREBUS ODORA (*Linn.*).— As examples of this large and beautiful noctuid are of rare occurrence in the State of New York, it may be noted that a female was identified by me, which had been taken at Oxford, Chenango county. Another instance of its occurrence, somewhat remarkable from the late date of its capture, is that of a male, taken at Schoharie, N. Y., within a wood-shed on November 2, 1858, in perfect condition (now in my collection), except as it had been injured by its fluttering on the pin with which it had been roughly impaled by the small boy who captured it.

Other recorded New York captures, are: a female, at Parkville, L. I., on June 16, 1880 (*Papilio*, ii, 1882, p. 18); an example, flying about a room, at New Dorp, Staten Island, in September of 1887; and two other specimens, on Staten Island, during the last few years, one "at sugar" and the other in a barn (*Proceed. Nat. Sci. Assoc. of Staten Island*, for May 12, 1888).

Although a southern form, and question has been made of its breeding in the northern localities where it has been found, Mr.

Fletcher has reported two captures of it at Ottawa (latitude 45°), and Mr. Saunders has cited several other instances of its capture in Canada during the past few years (*Canadian Entomologist*, xii, 1880, p. 211).

We have no knowledge of the early stages of this insect beyond some brief notes upon its eggs and the first stage of the caterpillar, made at Nassau, New Providence, by Mrs. Blake, and recorded by Mr. H. T. Fernald, in *Entomologica Americana*, iv, 1888, p. 36.

Zerene catenaria *Cramer.*— Numbers of this moth were taken by Mr. Erastus Corning, Jr., on the evening of September 21st, 1887, from the windows of a drug-store, fronting Capitol Park, to which they had evidently been attracted by the lights within. Fifty or more examples, it is thought, could have been taken at the time.

It may be readily recognized by its snow-white and unusually thin wings, crossed near their middle by two black, toothed lines — sometimes broken into lines of dots upon the nervules. The head, and front of the wing-covers are ochreous-yellow. The hinder margin of the wings is dotted with black at the end of the veins. The figure represents a male with its plumose antennæ; in the female they are thread-like.

Fig. 55. — Zerene catenaria. (After Emmons.)

For an account of a remarkable flight of this moth, in October, 1880, in Lackawaxen, Pa., which, from its immense numbers, appearing in some places as a dense snow-storm, alarmed farmers who foolishly feared that it was the precursor of an army-worm attack: — see *Report of the Commissioner of Agriculture*, for 1880, p. 274.

Anisopteryx pometaria *Harris.* — Caterpillars of this species, the fall canker-worm, which is of rare occurrence compared with the spring canker-worm, *A. vernata* Peck, were received from Moriches, Suffolk county, N. Y., on June eighth, from Mr. Augustus Floyd. They had made attack upon his apple trees and were rapidly consuming the foliage. Doubtless some of the attacks ascribed to *A. vernata*, in reality belong to this species, discrimination between the two not being made by the observer.

Through an error discovered too late for its correction, figures illustrating *A. vernata* were received from the Department of Agriculture, instead of those of *A. pometaria*, desired. They will, however, serve to show the form that more commonly comes under observation. In Figure 56, *a*, is the mature larva in its natural size: *b*

eggs in natural size and in enlargement; *c* and *d*, side and dorsal view of a segment of the larva enlarged. In Figure 57, *a*, is the male

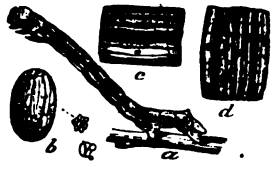

FIG. 56.— Larva and eggs of the spring canker-worm — ANISOPTERYX VERNATA. (After Riley.)

FIG. 57.— Male and female moths and enlargements of ANISOPTERYX VERNATA. (After Riley.)

moth and *b* the wingless female, each in natural size; *c*, enlargement of portion of female antennæ; *d*, joint of female abdomen, enlarged; *e*, its ovipositor, enlarged.

* TINEA PELLIONELLA *Linn.*— This notorious pest — the common clothes-moth, carpet-moth, fur-moth (different names for the same insect), etc., was first observed in flight in my office, as early as February thirteenth. During March, and especially toward the latter part of the month, the moths were not uncommon. On April twenty-third, note was made of their being quite numerous. They were also reported to me as flying in abundance, May fourteenth, from a bag with hops and pieces of flannel; the flannel was found almost entirely eaten.

The above early appearances of the insect are noted, as Professor Fernald, in his excellent paper discussing the confused synonymy of the species, states that "the moths emerge in June and July, and some even as late as August, yet there is but a single generation" (*Canadian Entomologist*, xiv, 1882, p. 167). Dr. Packard represents the moth as beginning to fly about our apartments in May (*Guide to the Study of Insects*, 1866, p. 346). Dr. Harris states that they lay their eggs in May or June, and indicates early June as the time in which the prudent housekeeper should beat up their quarters and put them to flight or destroy their eggs and young (*Insects Injurious to Vegetation*, 1862, pp. 493, 494).

Probably the nearly uniform day and night temperature of my office during the winter, maintained by the steam-heating arrangements of the Capitol, serve to shorten the period of pupation, when compared with its usual period in our dwellings.

* MALLOTA *sp.*— Professor L. M. Underwood, of Syracuse University, sends, January nineteenth, larvæ (3), puparium, and empty puparia (3), taken in Western New York, from between the boards

forming the walls of an out-house. They may have been of *Mallota barda*, to which they bore a resemblance, but they could not be positively identified, for unfortunately the examples sent had been put in alcohol, and none had been retained alive for rearing.

*Anthrenus scrophulariæ (*Linn.*).—The carpet-beetle occurred abundantly on flowers of *Spiræa*, in Washington Park, Albany, on June second. *Anthrenus varius* (Fabr.) was associated with it in about equal numbers.

June eighth, numbers were taken by Mr. William Beuttenmüller of New York city, on flowers of parsnip.

July twenty-first, twenty-five of the larvæ, of different sizes, were received from a residence in Schoharie, N. Y., where they abounded.

August ninth, Prof. H. M. Seely, of Middlebury College, Middlebury, Vt., sent what he believed to be the carpet-beetle, as it was found in large numbers associated with the *A. scrophulariæ* larvæ when searching for the latter in July. It proved, however, to be the *Otiorhynchus ligneus*, which appears of late to have domesticated itself within many dwellings (see *Second Report on the Insects of New York*, 1885, pp. 51, 52).

November second, half-grown larvæ and an imago were taken in my house, the latter from a window curtain.

Alaus oculatus (*Linn.*). — As this large snapping-beetle — the largest that occurs with us of its family, is often sent for name, the accompanying figure and brief notice of it are given as aid in its recognition.

It is an inch and a half long, with ribbed wing-covers spotted with white; its thorax one-third the entire length of the insect, largely covered with white scales like a white powder, and bearing centrally on each side, a large oval, velvet-black spot ringed with white. Its specific name is given to it from the marked resemblance of the two thoracic spots to eyes, for which they are commonly mistaken. It belongs to the family of *Elateridæ*, or spring beetles — the latter name referring to a peculiar arrangement of a spine and

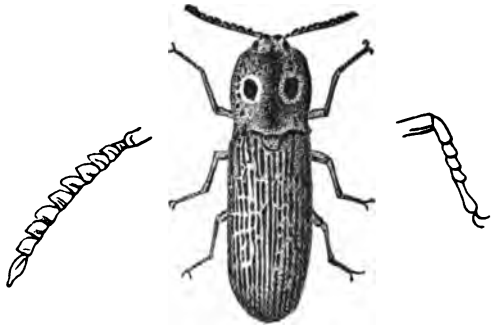

Fig. 58.—The owl beetle, Alaus oculatus, with enlargements of antenna and tarsus. (After Emmons.)

socket upon the lower side of the thorax and abdomen, by means of which the insect is able, when laid or fallen upon its back, to spring upwards several inches, and in dropping to regain its feet. Without this provision, it would be difficult for it to recover its position if left alone to the aid of its short and rigid legs. The larva is a borer in apple trees, but as it is mainly a feeder upon decaying wood, it can not be regarded as an injurious insect, except as it may hasten the destruction of a tree in which decay has already commenced.

* THANASIMUS DUBIUS (*Fabr.*).— Numbers of this insect — one of the *Cleridæ*—were observed upon cut pine timber, at Schoharie, May thirteenth, but dropping quickly to the ground when approached. They had probably been feeding on some of the wood-eating larvæ under the bark. A species nearly allied to this, captured by me upon the summit of Mt. Marcy, at an elevation of 5,300 feet, on August 8, 1877, has recently been identified by Mr. E. A. Schwarz, as *Clerus ? analis* LeConte.

* MACRODACTYLUS SUBSPINOSUS (*Fabr.*).— Under date of July fourth, Mr. H. J. Foster, of East Palmyra, N. Y., wrote that the rose-bug had made his cherry-trees leafless the preceding year, and that this year they were eating the leaves of the wild-grape, and the apples where they occur in clusters.

LEMA TRILINEATA *Oliv.*— Larvæ of this insect in various stages of growth, some mature and building up their white cocoons of frothy matter given out from their mouth, and also the perfect beetle feeding on a species of *Physalis*, were received August twenty-sixth, from Mr. M. H. Beckwith, of the New York State Agricultural Experiment Station at Geneva.

* CHRYSOCHUS AURATUS (*Fabr.*).— Professor S. A. Forbes, of Champaign, Illinois, has kindly communicated to me a new food-plant for this beetle, discovered in the State of New York. He had received, under the date of July seventh, from Mr. C. Fred Johnson, of Bayport, Suffolk Co., some "potato-bugs," which he identified as this species. It had "appeared only on a dozen or so plants, in a field of two acres, but as many as thirty or forty were found on a single plant." It had never before been recorded as occurring injuriously upon any cultivated plant.

* TRIRHABDA CANADENSIS (*Kirby*).— On the twenty-second of June, at Schoharie, N. Y., a large patch of the golden rod, *Solidago Canadensis*, was observed to be infested with numbers of shining black larvæ,

about a half-inch in length, and tapering toward each end. Of a number gathered and fed upon the golden rod, a half dozen had changed to the pupa state, ten days thereafter. On the fifteenth July, the beetles were disclosed, and proved to be one of the *Chrysomelidæ*, viz., *Trirhabda Canadensis* (Kirby). The ochre-yellow stripes of the elytra, at first quite bright, gradually dulled in their drying.

Numbers of the beetle were observed, on September eighth, feeding upon the leaves of the golden rod. When approached, they drop to the ground and lie motionless. Several pairs were in copula, and all of the females had the abdomen enormously distended with eggs. *Diabrotica vittata* (Fabr.) was also very abundant in the flowers of the plant, where it was feeding upon the pollen.

T. Canadensis has also been observed, abundantly, at Keene Valley, Essex county, N. Y., on golden rods, late in July and early in August. According to Dr. LeConte, it is a common insect, extending from Lake Superior and the Mississippi river to the Pacific. It was originally described by Kirby, in his *Fauna Boreali Americana*, from collections made in Canada by Dr. Bigsby.

Galeruca xanthomelæna (*Sch.*). — Examples of this beetle, so exceedingly destructive to elm trees, were received from Poughkeepsie, N. Y., where they had recently made their appearance. It was first observed about fifty years ago, in the vicinity of Baltimore, Md., and not long thereafter, it became a serious nuisance in Washington, D. C., and in New Jersey. During the last few years it has extended its ravages to Long Island and Westchester county, N. Y., where by its complete defoliation of large and beautiful elms, and by the myriads of the disgusting larvæ swarming on the trunks of the trees, it became a common object of observation and execration. It has continued to extend itself slowly in this State (and in Massachusetts), until we have it now in Poughkeepsie, midway between New York and Albany, which is the most northern locality within the State from which it has been reported.

The beetle and its operations upon the leaves of the elm, are shown in Figure 59, taken from the *Report of the Department of Agriculture* for 1883, in which the Entomologist, Professor Riley, has given the habits and natural history of the insect, the best remedies for it, and experiments made at Washington, with insecticides for its control. The same account has been reprinted as Bulletin No. 6, of the Division of Entomology, and also in Bulletin No. 10, of the Division — "Our Shade Trees and their Insect Defoliators." Copies of this last publica-

tion are perhaps still procurable upon application to the Department of Agriculture.

FIG. 59.— The Elm-leaf beetle, GALERUCA XANTHOMELÆNA, in its different stages.

In the figure, *a*, shows the eggs as they are deposited in clusters on the leaf; *b*, the larvæ; *c*, the beetle in natural size; *e*, the eggs enlarged; *f*, the sculpture under a high magnifying power; *g*, the larva in about twice its natural size; *h*, a side view of a segment of the larva; *i*, dorsal view of the same; *j* and *k*, the pupa and the beetle enlarged; *l*, a portion of the wing-cover of the beetle enlarged.

* HYLESINUS OPACULUS *Lec.*— This little bark-boring beetle (determined by Dr. Horn) was found by Professor C. H. Peck, State Botanist, under the bark of living, and to all appearance, healthy cedar trees (*Arbor vitæ*). They occurred May twenty-sixth, within their main galleries, with eggs laid at intervals, in niches on each side, from which, later, would run the lateral galleries of the larvæ. The beetle has hitherto been recorded only on elm and ash (*Ulmus* and *Fraxinus*).

PHLŒOTRIBUS LIMINARIS (*Harris*).— Numbers of this beetle, designated by Saunders as the elm-bark beetle, although perhaps more frequently

occurring in the peach, were emerging in my office June sixth, from sections of the trunk of a young peach tree, received from Mr. G. W. Duvall, from near Annapolis, Md. The tree had, it was believed, been killed by the insect the preceding year.

The main galleries of the beetles, are usually run transversely across the trunk, but at times are inclined at various angles up to forty-five degrees. The longest are about one inch and a half in length, by one-twentieth of an inch broad, and show plainly the row of niches on each side excavated for the reception of the eggs, and from which the galleries of the young larvæ proceed. These galleries are an inch and a half, or more, in length. Those central on the main gallery, extend at right angles to it, while those on each side thereof diverge at such angles as their greater breadth, consequent on the increasing size of the larvæ, necessitate. The galleries are not strictly rectilinear, but are somewhat waved.

Dr. Harris, Dr. Fitch, and subsequent writers mention this beetle as occurring under elm bark. I have never found it in such a situation. Mr. Schwarz gives as his experience, which in the *Scolytidæ* has been so extensive as to deserve being accepted as authoritative, that it does not occur under elm bark. He thinks that it has been confounded with *Hylesinus opaculus*, which is rather common under such conditions and which resembles it so closely that without examination of the antennal structure the two can hardly be separated (*Proceed. Entomolog. Soc. of Washington;* i 1888, p. 113).

Belostoma Americana *Leidy.*— Mr. B. D. Skinner, of Greenport, N. Y., in sending a living specimen of this "water-bug" for name, on February twenty-second, states that he only knows the insect as seen during the winter under the ice of a certain fresh-water pond near Greenport, on the Long Island coast. On a pleasant day when the ice is free from snow and clear, a dozen or two could be noticed in a short time, moving slowly along under the ice. Boys sometimes amuse themselves by lining their course, and cutting out a block of ice a little distance in front of them, upon reaching which, they rise up to the surface and are taken by hand.

Fig. 60. — Belostoma Americanum.

The insect is shown in Figure 60, reduced about one-fourth in size, from the example from which it was drawn. Large examples measure about one inch and one-half in length.

From the frequency with which this insect is attracted to electric

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lights, it has of late in many localities become known as "the electric-light bug."

CERESA BUBALUS (*Fabr.*). — Several twigs of apple-tree from the nursery of Maxwell Brothers, at Geneva, N. Y., communicated by Mr. Goff, contained the egg-deposits of the "buffalo tree-hopper." A piece of a twig two and a half inches long showed eighteen of these deposits, averaging eighteen eggs in each. Figure 61, represents the insect, enlarged to about twice its natural size.

FIG. 61.—CERESA BUBALUS (Fabr.), enlarged.

As the mode of oviposition has been differently described by different writers, and in some cases erroneously, it is with pleasure that we give place to a portion of a note recently communicated to the "Industrialist," of Manhattan, Kansas, upon the method of egg-laying in this insect, by Professor Popenoe, with the figures which satisfactorily illustrate it.

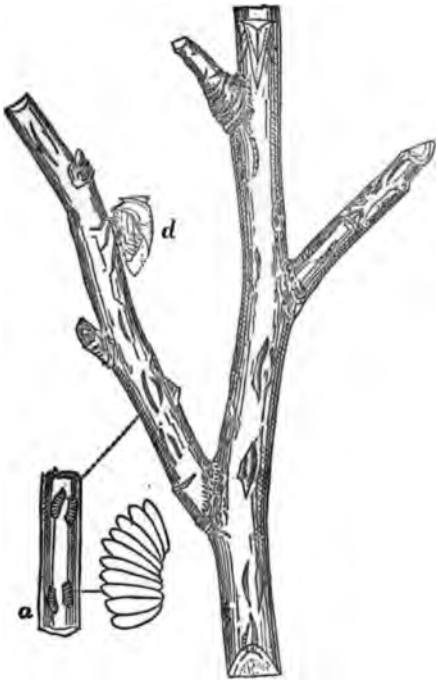

FIG. 62.—Oviposition of the Buffalo tree-hopper, CERESA BUBALUS; showing the insect at work, scars made by it in the wood, a section of a twig with bark removed with egg-clusters in place, and an enlarged egg-cluster. (After Popenoe.)

"The irregularly circular or oblong scars, resulting from the growth of the injured bark upon branches and twigs punctured by the insect in question, occur numerously on the twigs of various trees, especially upon the willow, soft maple and apple. In a young apple orchard in this vicinity, the scars were so numerous that the growth of the trees was lessened and their shape injured in consequence. The slits in the bark, made by the ovipositor of the female tree-hopper, are two in a place, slightly curved, their concave sides facing. The strip of bark between these slits is separated from the wood, as the insect thrusts the ovipositor from each slit to the bark under or beyond the opposite slit, the eggs in each row having been introduced through the slit above the opposite row. The growth of the bark is thus checked, and the incisions remain for several years as the irregular scars above noted. The wounds are made more numerously upon the upper side of the branch, and are often so abundant that the branch is deformed

in growth. The insect, which is well shown in a side view at *d* in the accompanying figure, is of a bright grass-green color, and very active, flying with a buzzing noise when approached. The insect in all stages feeds upon the juices of various plants. It is very generally distributed, but does not usually appear in such numbers as to be considered injurious.

Chermes pinicorticis *Fitch.*— From branches of pine badly infested with the pine-bark Chermes, taken in Washington Park, Albany, in the early part of June, immense numbers of this minute aphis emerged, during the latter part of June, a large proportion of which were of the winged form. The branches having been placed beneath a glass shade for convenience of observation, the insects as they emerged banked up in a pile against the rim on the side toward the light. A notice of the species, with figures, may be found in the *Second Rept. Ins. N. Y.*, 1885, pp. 180–184.

Œcanthus niveus *Harris.*— Peach twigs, badly scarred through the oviposition of this insect, the white flower-cricket, were received, in April, from Mr. O. Wilson, of Keuka, Chemung county, N. Y.

APPENDIX.

(A.)

SOME EXTRA-LIMITAL INSECTS.*

Carpocapsa saltitans Westwood,

And its Jumping Seeds.

(Ord. LEPIDOPTERA: Fam. TORTRICIDÆ.)

WESTWOOD: in Proc. Ashmolean Soc., iii, 1857, pp. 137-8; in Trans. Lond. Ent. Soc., ser. 2, iv, 1858, p. 27; in Gard. Chron., 1859, p. 909.

LUCAS: in Ann. Soc. Ent. France, ser. iii, vi, 1859—Bull., pp. 10, 33, 41, 44 (as *Carpocapsa Dehaisiana*); ib., vii, pp. 561-566 (as *C. Deshaisiana*).

LINTNER: in Albany Argus, for Oct. 11, 1875; in Proc. Alb. Institute, ii, 1878, pp. 264-266. in Count. Gent., xlix, 1884, p. 757; in Bull. Brook. Entomolog. Soc., vii, 1884, p. 92.

RILEY: in Trans. St. Louis Acad. Sci., iii, 1875, p. cxc.; in Amer. Nat., x, 1876, pp. 216-218; in Proc. U. S. Nat. Mus., v, 188, pp. 632-635, fig.

DODGE: in Field and Forest, ii, 1876, p. 54-5.

FERNALD: Cat. Tortric. N. A., 1882, p. 54, No. 396; in Trans. Amer. Ent. Soc., x, 1882.

The Seeds.

The so-called "Mexican jumping seeds," whenever observed, excite so much curiosity that the following information is offered of them.

The seeds are about four-tenths of an inch long, and of about the same width, smooth on the outer surface, bisected by lines which show them to be two-valved, and of a form indicating that they had been united in a globular three-celled ovary. In shape they are sub-triangular, their two inner sides plain and meeting at an obtuse angle, and the outer side rounded. They are shown in two views in the figure, at *e* and *f*. They are known to the inhabitants of Sonora as "brincaderos," meaning jumpers.

History of the Insect.

Their peculiar jumping movements have made them objects of much interest since they were first brought to scientific notice in the year 1857, through specimens sent from Mexico by the British Chargé d'Affaires, and exhibited to the Entomological Society of London by the secretary. The seeds were said to be a species of *Euphorbia*, and they were supposed to contain a lepidopterous larva.

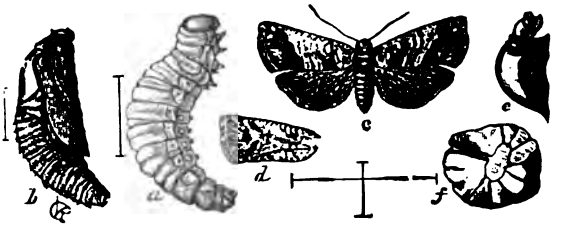

FIG. 63.—CARPOCAPSA SALTITANS; *a*, the larva; *b*, the pupa; *c*, the moth; *d*, wing of a pale variety; *e*, seed with pupa-case; *f*, seed from its lower side.

* The insects herewith noticed are not known to the writer to occur in the State of New York, and are therefore separated from the "Injurious and other Insects of the State of New York" of the preceding pages.

In June of the following year, Professor J. O. Westwood exhibited to the society the perfect insect (a moth) which he had bred from the seeds, and in an accompanying paper described and named as *Carpocapsa saltitans*. It is shown at *c* in the figure.

A few months later, M. Lucas, in ignorance of Professor Westwood's work, in a paper entitled "Observations sur une nouvelle espèce de Carpocapsa, et remarques sur les movements que la chenille de la Lépidoptère imprime a des graines d'une Euphorbe du Mexique, dans lesquelles elle se metamorphose," published in November, of 1858, in the *Revue et Magazin de Zoölogie* — redescribed and named the insect as *Carpocapsa Dehaisiana*. Under this latter name some examples were exhibited by me and remarked upon at a meeting of the Albany Institute, on October 5, 1875.

In the *Gardener's Chronicle* of November 12, 1859 (*l. c.*), Prof. Westwood has given an interesting paper on these seeds, in which they and the moth that they disclose are described and figured.

Its Generic Relations.

The insect belongs to the family of comparatively small moths known as *Tortricidæ*, the larvæ of which are mainly "leaf-rollers." Its generic relations are of particular interest, since it pertains to the same genus with the codling-moth, *Carpocapsa pomonella*. The larva of the codling-moth is the common and well-known apple-worm, which is so very destructive to apples in this country and in Europe, tunneling and disfiguring them with its excremental-crowded burrows and unsightly "worm-holes." It has, however, entirely different habits during its progress to maturity and subsequent transformations, nor has it ever shown any jumping propensities.

Its Jumping Movements.

The ordinary "jumps" of the *C. saltitans* are successive leaps of about one-eighth of an inch in length, repeated at intervals of a second or two. At times, however, they are more violent — turning the seed-vessel from one of its flat sides, to its concave surface, spinning it around upon one end, or projecting it, with an irregular rolling motion, to a distance of an inch or more. When held in the hand, the jumps give quite a perceptible impulse to the palm. Placed upon a small table, in a few minutes several will have thrown themselves over its edges upon the floor. If confined in a box, they in a short time become quiet, and no sound is heard from them; but upon opening and exposing them to the light, the motions are at once moderately resumed. If further disturbed by being turned out upon a table or into the hand, their more violent motions soon commence, and continue for a long time.

Their peculiar movements are said by Prof. Riley, to be produced by the larva holding fast to the silk lining of the seed-vessel with its three hinder pairs of strongly hooked abdominal legs, and in this position, with the anterior portion of its body curved upward, violently tapping the walls with its head, sometimes thrown from side to side, but more often brought directly down, as in the motion of a woodpecker's head when tapping for insects.

Another Species Reared from the Seeds.

A package of these seeds was received by me in August, 188., from a correspondent at Garrisons, N. Y., to whom they had come by mail without any indication of their source. Soon after opening the box, and leaving its contents exposed on my table, a moth was noticed on the window of my office. It was captured, and from its general appearance, its source was naturally referred to the Euphorbia seeds; and as confirmatory, on examination, a seed was found split open in the middle and with twisted valves. The moth had evidently escaped from it. With no knowledge at the time of the appearance and structure of the *Carpocapsa saltitans*, the above example was accepted as that species, and referred to as such in a communication on "Jumping Seeds" made to the *Country Gentleman*, of September 11, 1884. The peculiar structure of its hinder legs—the tibiæ and tarsi of which were broadly dilated (it was a male)—seemed so unlike a *Carpocapsa*, that a reëxamination and study was made of it later, with the interesting result that it was the insect which Lord Walsingham had described as *Carpocapsa latiferreana*,* and for which Professor Riley, from the structural peculiarities above noticed and others, had subsequently established the genus *Mellisopus*.†

Prof. Fernald, in his *Catalogue of the Tortricidæ of North America*, has given as the habitat of *M. latiferreana*, New Hampshire, Missouri, California, and Texas, and for its food, oak acorns. If knowledge of its food is hitherto limited to this statement, the escape of an example from a Euphorbia seed, is an interesting incident. Will its larva prove to be a "jumper?" Its manner of escape, through the splitting of the seed, is quite different from that of *C. saltitans*, to be described hereafter.

Active Period of the Seeds.

In writing of these seeds, under date of September third, after the emergence of *M. latiferreana*, it was stated that the remainder (thirty-two in number) were at that time in their larval stage, as each one showed active motions, which are limited, it is believed, to this stage.

The seeds were shown and remarked upon at the meeting of the American Association for the Advancement of Science, in September, 1884, when their strange movements excited much interest in those who saw them for the first time. No note was made, unfortunately, of the time when their motions ceased. Such observation would probably have marked the approximate time of the larval change to pupation. So late as November first, all but two continued active, though not to the extent displayed in early September.

Soon after their reception one of the seed-vessels was partially crushed by accident, disclosing the larva within. The day following, the broken and separated walls were found to have been repaired and firmly united by a thick interior coating of silk.

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*Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum. Part IV,—North American Tortricidæ. London, 1879, p. 70, pl. 76, fig. 8.

† *Transactions of the St. Louis Academy of Science*, iv, 1881, p. 322; *American Naturalist*, xv, 1881, p. 480.

Emergence of the Moth from the Seed-Vessel.

The first moth made its appearance on the 13th of April, 1885, having escaped from its box and alighted on my table in the evening, where it had been attracted by the light. Of the twenty seeds that had been retained, fourteen at this time showed the small (nearly one-tenth of an inch in diameter) rounded interior larval cutting, the outer shell of which would be separated and pushed off as a lid for the escape of the imago. In each instance this mark was on the lower end of the outer surface of the seed, nearly opposite to the scar of the inner surfaces, and in all but two was so nearly central as to embrace the carina. The seeds not thus marked, without doubt, contained dead insects.

This method of preparation for the escape of the imago is quite different from that given by Prof. Riley, in the *Transactions of the St. Louis Academy of Science* (*loc. cit.*), which is as follows: "Toward the month of February the larva eats a circular hole through the hard shell of its habitation, and then closes it again with a little plug of silk so admirably adjusted that the future moth, which will have no jaws to cut with, may escape from its prison."

Examination of the lid of the aperture through which the insect has effected its escape, will show that it consists only of the outer wall of the seed — the inner wall and the thicker white connecting material between the two, having been eaten away. A slight pressure by the pupa would suffice for detaching and forcing open the lid, which frequently retains its attachment to the seed by a few fibres at one point. The empty pupa-case is often held in the opening (as represented in figure 63 at *e*), as in the *Ægeriadæ*, to those of which its abdominal bands of teeth gives it resemblance.

When the Moths are Disclosed.

Each of the fourteen seeds disclosed its imago. Their time of appearance was very unequal — the first moth emerging April thirteenth, as previously stated, and the last September twentieth. Those reared in Paris by M. Lucas were obtained between the tenth and twentieth of February, and in London, by Professor Westwood, during the same month.

Other Jumping Seeds.

In addition to the above, three other "jumping seeds," according to Dr. Hagen, are known, viz.: An Euphorbia, also of Mexico, containing a small hymenopterous insects; a Tamarix, of Algiers, containing a coleopterous larva bearing the name of *Nanophyes tamariscis;* and another, the seed of which is unknown by name, in which a hymenopterous insect undergoes its transformations.

Further information in regard to these seeds and their insect guests may be found in the *American Naturalist* for April, 1876 (*loc. cit.*), in an article entitled "Jumping Seeds and Galls," by C. V. Riley; by the same, in the *Proceedings of the U. S. National Museum* (*loc. cit.*); and in *Field and Forest*, by its editor, Mr. Charles R. Dodge, as cited.

Systena blanda Melsh.

The Broad-striped Flea-beetle.

(Ord. Coleoptera: Fam. Chrysomelidæ.)

Melsheimer: in Proc. Acad. Nat. Sci. Phila., iii, 184—, p. 164.
LeConte: in Smithson. Contrib. Knowl., xi, 1859, p. 26 (as *Systena bitæniata*).
Crotch: in Proc. Acad. Nat. Sci. Phila. [xxiv], 1873, p. 69.
Glover: in Rept. Commis. Agricul. for 1873, p. 152, fig. 1 (feeds on corn).
Le Baron: 4th Rept. Ins. Ill., 1874, p. 173.
Forbes: 13th Rept. Ins. Ill., 1884, p. 86 (on strawberry).
Henshaw: List of Coleop. of N. Amer., 1885, p. 112, No. 7003.
Hunt: in Miss. Ess. Econom. Ent., 1886, p. 105–6 (bibliog. of corn-eating insects).
Lintner: in Count. Gent., lii, 1887, p. 441 (on cotton).

Examples of this beetle were received in May, from Jackson county, Ga., accompanied with the following statement of serious injuries committed by them.

Reported as a Cotton Pest.

"I send you a small bug that is eating my cotton plants, and a few of the plants that they have been feeding on. I do not find them except where the cotton was planted on stubble land, on which the common ragweed grew after oats, last year. A portion of the field was turned last September; the balance was not plowed until March. The same little bug killed almost entirely, last year, about eight acres of cotton that was planted after ragweed. I will be greatly obliged for a suggestion of a practical remedy."

Description of the Insect.

The beetles sent with the above reported attack, are of the family of *Chrysomelidæ*, or leaf-eaters, and are known scientifically as *Systena blanda* Mels. They belong to a variety known as *bitæniata* LeConte, as kindly determined by Dr. Horn, having been described as a distinct species from some individuals of a large form and dark color, but which were subsequently found to be but varietal features. The beetles are elongate, slender, dull ochreous-yellow, with a black stripe on the inner and outer margin of each wing-cover—the two inner ones from their coalescence appearing as one; the space intermediate to the marginal black stripes presenting the appearance of a broad yellow stripe. The wing-covers have the punctures irregularly distributed instead of arranged in rows.

The beetle is figured by Mr. Glover in the Report of the Commissioner of Agriculture, for 1873.

Crops Attacked by it.

The insect has not hitherto been reported as attacking the cotton plant, and indeed no notices have appeared of extensive injuries by it to any valuable crop, except to corn.

In June, of 1873, examples of the beetle were sent for name to the Department of Agriculture at Washington, from Chambersburgh, Pa., with the statement that they had nearly devastated a field of corn, having eaten the leaves and left the bare stalks standing. They were observed to be very voracious and quite active, hopping like fleas, and hiding in the soil if there was not time to escape by flying away.

Dr. Le Baron has referred to it (*loc. cit.*) as injurious to young corn in the Middle States, but has given no particulars.

Professor Forbes, in the Thirteenth Illinois Report, states that it was especially abundant near Anna, in Southern Illinois, where it was feeding on the leaves of the strawberry, as was demonstrated by dissection of its stomach.

Professor F. M. Webster has observed it in Indiana feeding injuriously upon the potato. He states that in a locality visited by him, where the Colorado potato-beetle was common, far more damage had been done in eating the leaves by the adult *Systena blanda*, and to a less degree by *Systena frontalis* (*Report Commis. Agricul.* for 1887, p. 150).

Preventives and Remedies.

This beetle may not be expected to prove a very serious pest of the cotton. As it seems, from the communication sent, to be so associated with the ragweed [*Ambrosia*], a natural and simple preventive of its injuries should be found in the destruction of the weed on which it may be supposed to feed and develop in the autumn.

When found on the young cotton plants, relief can be obtained by sprinkling dust, fine sand, ashes, or some similar material over the leaves when wet with dew, or any other of the methods commonly resorted to for protection from the cucumber flea-beetle, *Crepidodera cucumeris*, an insect having similar habits, and to which it is nearly allied. The *Systenas* are not regarded as injurious insects usually. Their attacks are often quite local, although serious at times, as that of the red-headed Systena, *Systena frontalis* (Fabr.), has been in portions of the Province of Ontario on grapevines,* and also, on many garden plants the present year (1887), † and *Systena marginalis* (Ill.) on oaks, elms, and hickory in the same province.

The habitat of *S. blanda* is given as "Atlantic region and New Mexico." Its range seems to embrace several of the Western States. I have no knowledge of its occurrence within the State of New York.

Leptocoris trivittatus (Say).

The Box-elder Plant-bug.

(Ord. HEMIPTERA: Subord: HETEROPTERA: Fam. BERYTIDÆ.)

Lygæus trivittatus SAY: in Journ. Acad. Nat. Sci. Phil., iv, 1825, p. 322; Compl. Writ., Lec. edit., 1883, p. 246.

Leptocoris trivittatus STAL: Enum. Hemipt., i, , p. 226.

" " GLOVER: MS. Notes Journ.—Hemipt., 1876, p. 43, pl. 4, fig. 24.

" " UHLER: List Hemipt. West Miss. Riv., 1876, p. 35; in Bull. U. S. G.-G. Surv. Terr., i, 1876, p. 301; Ch. List Hemipt. N. A., 1886, p. 13, No. 606.

" " POPENOE: in Amer. Entomol., iii, 1880, p. 162.

" " LINTNER: in Count. Gent., lii, 1887, p. 69.

" " RILEY: in Bull. No. 12, Div. Entomol.—U. S. Dept. Agricul., 1886, p. 41, pl. 1, fig. 5.

Numbers Occurring on Shade Trees.

A number of examples of a hemipterous insect, belonging to the "plant bugs," were received in their living state early in January, from Sterling, Kansas. Although they had not been observed as inflicting any injury

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* Saunder's *Insects Injurious to Fruits*, 1883, p. 283.

† The *Ottawa Naturalist*, ii, 1888, page 22.

upon the trees on which they occurred, or elsewhere, they had excited much curiosity from occurring in such numbers, from their general distribution, and from their continuing so late in the winter. Their contributor, Mr. J. M. Moore, could give no particular account of them: they had been found everywhere during the autumn and winter, and had first been noticed in the early autumn. They were said to be more numerous where the box-elder tree abounded. A friend had reported to him their great abundance in the Indian Territory, during the summer, in and around the tents of his party, where they were known as the "honey-bug" [perhaps from the odor peculiar to them].

Description.

The insect, shown in Figure 64, is one-half inch long by two-tenths of an inch broad, flat upon the upper side; the thorax with a central line and the sides red; the thick portion (coriaceous) of its wing-covers margined on the sides and behind with red; the lower sides of the body is red in places. It was originally described by Say in the Journal of the Academy of Natural Sciences of Philadelphia, iv, as *Lygæus trivittatus*, the specific name being drawn from the three red thoracic stripes. It has subsequently found place in the genus *Leptocoris*. The type specimens were from Missouri. Say's description is as follows:

"Body black; eyes and stemmata sanguineous; thorax mutic; two indented transverse lines near the head, of which the anterior one is curved in the middle; three bright rufous lines, of which two are marginal; posterior edge obscurely rufous; hemelytra, coriaceous portion with a rufous exterior and posterior margin; membranaceous tip immaculate; trochanters rufous; tergum rufous with three lateral black punctures; venter, margin, and middle rufous. Length nine-twentieths of an inch."

FIG. 64.—The box-elder plant-bug, LEPTOCORIS TRIVITTATUS.

Observed in Kansas.

The abundance noticed above is doubtless unusual. Our correspondent had never noticed the insect before, and it has apparently received but little attention, for the only notice of its habits that is found of it is the following communication from Prof. E. A. Popenoe, of Topeka, Kansas, in the *American Entomologist* for July, 1880, vol. iii, p. 162:

Last fall the box-elders, young soft maples and ash trees on the college grounds, were infested by a black, red-lined plant-bug—the *Leptocoris trivittatus* of Say—that punctured the bark of the trunk and limbs, feeding upon the sap. These bugs have passed the winter in sheltered situations in considerable numbers, and may prove troublesome during the coming season. The young bugs are most injurious, as they appear in much greater numbers, but may be brushed from the trees with a broom and destroyed upon the ground. This mode of operation is rendered the more successful by their habits of congregating on certain parts of the tree at this age. They are then chiefly red in color, acquiring the black with their wings in the adult state.

Its Favorite Food-plant.

The box-elder for which the bugs showed the preference, is the *Negundo aceroides*, nearly allied to the maples, and sometimes known by the com-

mon name of the ash-leaved maple. It is not, I believe, native to the State of New York, but occurs southward and westward from Pennsylvania.

Distribution.

The three-striped Leptocoris — the only U. S. species of the genus — is a western form, not occurring east of the Mississippi river. Its distribution, according to Uhler, is Colorado, Arizona, California, Kansas, Missouri and Mexico. It was observed by Prof. Uhler, at Cañon City, Cal., on August eleventh, at the roots of Cacti and Yuccas. It was found by Dr. Packard on July twenty-second, at the American Fork Cañon, Utah.

Develops a Fondness for Fruit.

The above was substantially communicated to the *Country Gentleman* for the issue of January 27, 1887 (see page 193 of this report). Since that time, the insect has been publicly presented under a more serious aspect than that of infesting shade trees — in that of a fruit depredator. As quite an interesting addition to our knowledge of its habits, the following transcription is made from Bulletin No. 12, of the Division of Entomology, U. S. Department of Agriculture, bearing date of 1886, and distributed in May, 1887. The figure given on the preceding page is from the same source.

Leptocoris trivittata injuring apples.— This bug is quite a common species and has been found in a great variety of situations. It is characteristically a plant-feeder, but has never been known to occur in such numbers as to do much damage to any cultivated crop. It has been found in large flowers like magnolia, covered with pollen, and occurs in summer on the stems and leaves of annual plants, which it probably punctures. In August of the present year, however, specimens were sent to us by Mr. A. L. Siler, of Ranch, Kane county, Utah, as injuring fruit at Kanab, the county seat of the same county. Mr. Siler's attention was called to them by the postmaster, Mr. B. L. Young, who stated that these insects were destroying their fruit crop, eating the fruit as fast as it ripened. On one tree which Mr. Siler examined, and which bore apples of a medium size, they were present in enormous numbers, and every apple that he could see was covered with the bugs. They were stated to have bred on the box-elder shade trees (*Negunda aceroides*).

Whether the bug breeds, as above stated, on the box-elder, or simply frequents it from some preference entertained for it — all the accounts associating it with that tree, its designation in popular parlance, as "the box-elder plant-bug," would be quite appropriate for it.

Mantis Carolina Linnæus.

The Carolina Mantis.

(Ord. ORTHOPTERA: Fam. MANTIDÆ.)

LINNÆUS: Syst. Nat., 12th edit., ii, 1756, p. 691.

FITCH: in Amer. Quart. Journ. Agr.-Sci., vi, 1847, p. 146 (as *Gryllus*).

THOMAS: in Trans. Ill. St. Agr. Soc., v. p. 441.

GLOVER: in Rept. Comm. Agr. for 1866, p. 40 (habits, etc.); id. for 1874, p. 133-4 (description and habits).

WALSH-RILEY: in Amer. Entomol., i, 1868, p. 59 (habits and oviposition).

RILEY: 1st Rept. Ins. Mo., 1869, pp. 169-171, figs. 94, 95 (general account); in 1st Rept. U. S. Entomolog. Comm., 1878, p. 334 (eats locusts); in 4th Rept. id., 1885, p. 99, fig. 25 (eats cotton-worms).

Packard: Guide Stud. Ins., 1869, p. 574, fig. 568; in 3d Rept. U. S. Entomolog. Comm., 1883, pp. 310-312 (anatomy).
Hubbard: Orange Insects, 1885, pp. 189, 190, figs. 90, 91.
Lintner: in Count. Gent., III, 1887, p. 9 (eggs, etc.).

The Egg-Packet.

Two egg-packets, readily referable to *Mantis Carolina*, were received from Mr. C. M. Hedges, of Charlottsville, Va., one of which had given out the young insects which were sent with it, during the preceding April—the other, with its eggs unhatched, was taken in the month of December. Both were found on exposed board fences, and several others had been seen during the autumn. They were accompanied with a request for some information respecting them.

Fig. 65.—Egg-packets of Mantis Carolina.

These strange-looking objects would probably not have been recognized by their collector as containing eggs had not the hatched insects disclosed their nature. They are in masses of considerable size, as shown in the accompanying figure, of a gray color, over an inch long by one half-inch broad and one-fourth of an inch high, rounded at one end and pointed at the other. In general shape, they resemble a small boat turned bottom upward; and this resemblance is still more marked in the broad, flat, keel-like structure that traverses its length.

Careful examination will show from twenty to twenty-five layers in the packet, or more correctly, as many folds on each side, indicating, if each such fold contains a single egg, from forty to fifty as the usual number of eggs. From a larger cluster than the above, sent to me in February, by Mr. C. R. Moore, of Birds Nest, Va., sixty-five young Mantis subsequently emerged.

This strange-looking object is well represented in the figure, except that the "keel" does not present the *braided* appearance there shown, but could be better illustrated by corrugating in short folds a narrow strip of flexible card-board, and then pressing at the ends until the folds touch one another in the center. They are simply in contact centrally, and not interlaced, as made to appear in the figure.

How are the Eggs Deposited?

The manner in which the eggs are deposited does not appear to be positively known—whether each one is extruded singly and the entire mass built up symmetrically by successive additions, as are the egg-pods of some other members of the same order of Orthoptera, the grasshoppers (see the oviposition of the Rocky Mountain locust, in the *First Rept. of the U. S. Entomological Commission*, pp. 223–225, figs. 1–4), or if, as in other Orthopteræ, as the cockroach and Croton-bug, it is slowly extruded as a full-formed egg-case. That it is not free, but fastened by its under surface to boards or branches of trees, even adapting itself to curves in the latter, would apparently indicate that it is built up on the surface where it is placed. Prof. Riley, in his First Report,

published in 1869, has written of it: "I have found the mass while it was yet quite soft and freshly laid, and have dissected the female just before she was about to deposit, and I incline to believe that it is gradually protruded in a soft, mucilaginous state, being covered at the time with a white, frothy, spittle-like substance, which soon hardens and becomes brittle upon exposure to the air." One who had witnessed the operation has rather vaguely stated of it that the eggs are "pumped out, and the entire mass elaborately shaped, with a fine instinct of construction as the process continues."

Arrangement of the Egg-Packet.

Apparently, the most reliable account of the structure of the packet and its deposit, is that given by Mr. H. G. Hubbard, in his *Insects Affecting the Orange*, which states: "The eggs occupy flattened cells, placed in two ranks, alternating with each other; the cluster of cells has a braided or woven appearance, but consists simply of a continuous ribbon of mucus, folded in close flutings, and having an egg deposited in the bight or angle of each fold. The eggs are deposited simultaneously with the deposition of this ribbon by the mother insect, and the whole mass is at first soft and flexible, but rapidly hardens by exposure to the air.

The eggs are laid during the month of September, and are hatched in June of the following year.

Egg-packets of Other Species.

Prof. Westwood, in his *Classification of Insects* (i, p. 424), has figured the egg-mass of a Brazilian Mantis, which is attached to a twig at its base, and resembles a seed-pod, being of a green color, and terminating in a long, acute point; and another case of a species from Bengal, of an oval, nearly globular form, attached to a twig by its longest diameter, with its keel upward.

Appearance of the Insect.

The insect produced from these eggs is of so peculiar and unusual an appearance, that in the Southern States where it occurs, it has received the popular names of "rear-horse," "race-horse," "praying Mantis," "camel-cricket," and even "the devil's riding-horse." In Europe they are known as sooth-sayers, diviners (*prie-Dieu* in France), from their strange attitude when at rest, as if engaged in prayer, with uplifted hands. It is a brownish or yellow-green long-legged creature, two inches or more in length, broad-bodied in the female, but narrow in the male; the many-veined thin wings resemble folded leaves; the front wings have each a brown spot centrally, and are borne rather flat over the back; the thorax is slender and almost as long as the body, looking like an elongated neck; the head is small, but much broader than it is long, triangular, and carried vertically. The two sexes—the slender male and the stouter female, are shown in Figure 66, from Professor Riley's First Missouri Report.

Its Food and Habits.

When the Mantis is disturbed, it raises its long back almost perpendicularly, with its long, stout, heavily-spined fore-legs in position for striking out at any object with which it is threatened. Its food consists entirely of living insects. In making its captures, it either lies motionless for hours at a time in wait for its prey, or else steals so slowly upon them that its

motion is hardly perceptible, until it has approached within suitable distance, when its powerful prehensile legs are suddenly thrown forward, grasping its victim, which is then held securely between the two spined joints of the legs folded one on the other, and devoured while struggling for escape. The food of the young consists largely of plant-lice, but as they mature they catch and consume quite large insects. They feed upon flies eagerly; they are believed to destroy large numbers of cotton-worms in the Southern fields; and they even prey upon the Rocky Mountain locust, as appears from the First Report of the U. S. Entomological Commission, page 334. Prof. Riley states (*Report of the Entomologist* for 1883, p. 163) that they feed on the elm-leaf beetle, *Galeruca xanthomelæna*.

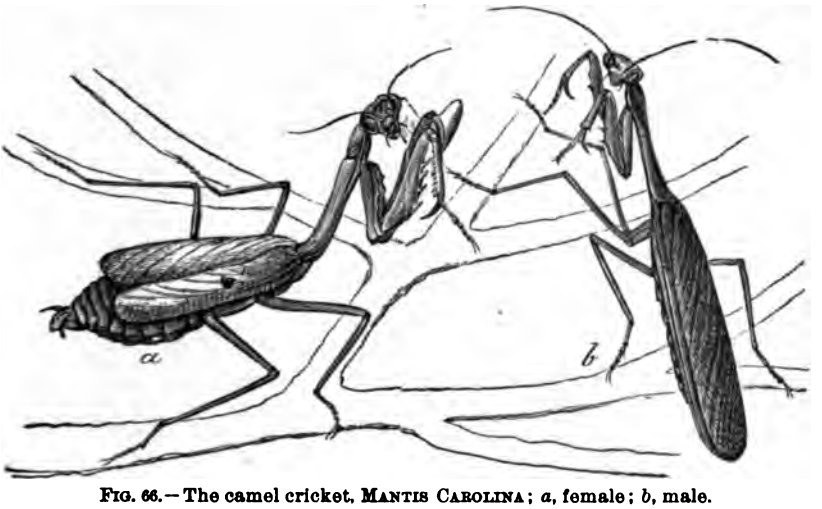

FIG. 66.—The camel cricket, MANTIS CAROLINA; *a*, female; *b*, male.

Mr. Hubbard (p. 189, *op. cit.*) records them as catching every moving insect that comes within their reach on the orange trees in Florida. Their voracity frequently leads them to devour one another, not only when just from the egg, when other food may not be convenient, but not unfrequently the amorous male falls a victim to the stronger-bodied female. A writer has stated: "The females being much larger, stronger and more rapacious than their mates, will frequently seize and kill them, and afterward make a good meal from their quivering bodies."

Its Distribution and Usefulness.

Mantis Carolina is a southern insect, abundant about Washington, D. C., but never occurring in the State of New York. Glover has stated that they have been successfully raised as far north as the Hudson river by bringing the egg-cases from the Middle States. Several cases were found fastened to the trees the next autumn, but after that they entirely disappeared. The eggs, probably, can not endure our northern winters. Could it be introduced and acclimated in our Northern States, it would be quite desirable to do so, for it certainly renders great service in the large number of noxious insects that it consumes in order to satisfy its voracity. An instance is related of a single female devouring eleven living Colorado

potato beetles in one night, leaving only the wing-cases and parts of the legs.

It follows from the above statement of habits, that wherever this insect occurs, either in the egg or imago state, it is well deserving of being spared from the indiscriminate destruction usually extended to all of the insect world, in the mistaken idea that only harm can come from this class of animated nature. The number of beneficial insects is very large — by far too large to attempt their enumeration. There are entire families which are composed of only such species as are of eminent service to mankind.

Other Species of Mantis.

Figure 67, from Westwood, represents an European species which is quite common in the south of France—the *Mantis religiosa* Linn., commonly known as the *Prie-Dieu*. It is regarded as performing its devotions, when it has assumed its usual attitude with uplifted fore-legs, while, in reality it is lying in wait for its prey. Its conduct at such times has been thus described:

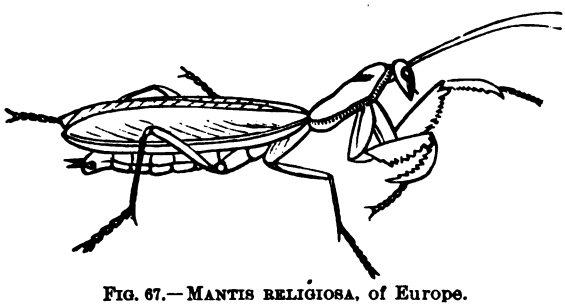

FIG. 67.—MANTIS RELIGIOSA, of Europe.

Settled on the ground, it raises its head and thorax, clasps together the joints of its front legs, and remains thus, motionless for hours together. But only let an imprudent fly come nearly within reach of our devotee, and you will see it stealthily approach it, like a cat who is watching a mouse, and with so much precaution that you can scarcely see that it is moving. Then, all of a sudden, as quick as lightning, it seizes its victim between its legs, provided with sharp spines which cross each other, conveys it to its mouth and devours it. Our make-believe nun, Preacher, Prie-Dieu, is nothing better than a patient watcher and pitiless destroyer.

Mantis oratoria Linn., is another European species, of smaller size, and less commonly met with. A South-American species, *Mantis argentina*, according to Burmeister, seizes and eats small birds.

A species of *Mantis*, not yet determined, has been sent to me, by Mr. W. E. Walsh, of Benson, Arizona, as feeding on vegetation [?]. It is a more robust form than the *M. Carolina*. Its fore-wings are leaf-green, quite broad — their breadth being nearly one-half their length. The stigma is merely defined by its elevated margin, not being marked with color as in *M. Carolina*. The hind-wings are crossed with about fifteen broken bands. The anterior legs are quite stout and more strongly and numerously spined than in *Carolina*. The prothorax is broad over the base of the fore-legs, and but slightly toothed on the sides.

In Mr. Scudder's "Catalogue of the Orthoptera of North America," four species of *Mantis* are named as occurring in the United States, of which I have no knowledge, viz.: *Mantis chlorophaca* De Haan, Watertown, N. Y.; *M. geminata* Stoll, Georgia or Virginia; *M. inquinata* [illegible] lina; and *M. phryganoides* Serv., New York [illegible]

(B.)

ENTOMOLOGICAL ADDRESSES.

The republication of the following papers of the Entomologist seems desirable, in consideration of their having been printed without the opportunity of correcting, in proof, the many typographical and other errors that they present; and further, that no extra copies (of the first two) were secured by the author for distribution to those whom they would fail to reach in their original issue, and to whom they might be of value or of interest:

[From Proceedings of the 24th Convocation of the University of the State of New York.]

THE PRESENT STATE OF ENTOMOLOGICAL SCIENCE IN THE UNITED STATES.

(Read before the Convocation at its Meeting on July 7, 1886.)

It would seem proper that a paper upon the present state of entomological science in our country should be prefaced by a history of its progress. But in two attempts made by me to sketch this history very briefly, the sketches have grown to such a length as in themselves to occupy all the time allotted for this paper. I have therefore laid them aside for the present, and will only ask your indulgence for a few introductory remarks.

Early Entomological Studies.

Entomology, as a science—although its foundations were laid three hundred and fifty years B. C. by Aristotle, the father of zoölogy, the pupil of Plato, and preceptor of Alexander the Great—can only date in this country to a period within the memory of many of those now living. True, the ravages of insect pests had previously been observed by agriculturists and recorded in agricultural and scientific journals, as those of the "army-worm" (then called the black worm) in 1743, of the Hessian fly, in 1768, and of the chinch-bug in 1783:—scientific study and description had been made by Peck, afterward a professor of natural history in Harvard College, of a noted insect pest throughout New England, the canker-worm, in 1795:—collections of our insects of considerable magnitude had been made by naturalists from abroad and taken to Europe during the latter half of the eighteenth century, where they were described and named by Linnæus, Fabricius, Drury, and others:—a work upon American insects, entitled "Natural History of the Rarer Lepidoptera of Georgia," in two volumes, folio, with colored plates of insects and their early stages, which has justly been styled an "ouvrage de luxe," bears date of 1797, but of the London imprint, having been edited by a distinguished English botanist, and published through the subscriptions largely of the English nobility:—as early as 1806 a catalogue of the insects of Pennsylvania was published by Melsheimer, giving the names of 1,363 species, but they were merely traditional names, unaccompanied by descriptions, of which only 205 can now be identified.—Yet, while we bear in grateful remembrance these early entomological studies, together with others of the kind that may not now be referred to, it is without disparagement of them that we find the foundation of entomological science in the United States, in the systematic study, description and publica-

tion of our insects by Thomas Say, the author of "American Entomology," the first chapters of which were issued in 1817.

Following these studies came scores of earnest and successful workers, who have contributed in giving to our science the proud position that it now holds. The simple enumeration of their names would be too long a list for the present occasion. Their labors are held in grateful appreciation wherever natural history is cultivated, and they are the acknowledged peers of any of their European collaborators.

SPECIAL STUDIES OF INSECT ORDERS.

It is perhaps fortunate that the field of study presented to the entomological student is so broad, that if he would render the best service to the science—instead of frittering his labor over the entire field, he is compelled to become a specialist and confine himself to a single group of ordinal or even family value.

It is for this reason that the knowledge of our insects shows quite unequal development in the several orders in which the class is divided. The two orders that are the most advanced are the Coleoptera (beetles) and the Lepidoptera (butterflies and moths). Of these, the several families have been systematically worked and catalogued, and it is possible for the student to name most of the specimens contained in his cabinet, by the aid of synoptical tables which have been prepared; while in the other five orders (as most generally accepted), the original descriptions will have to be consulted when accessible in their scattered and perplexing distribution throughout numerous scientific journals; or the material for which name and classification is desired, must be submitted to specialists in the orders who have the disposition and the time to devote to such usually unremunerative work.

The Coleoptera, from the facility with which the collections are made and their simple preparation for the cabinet, have received the most study. About ten thousand of our species are known, described, and catalogued. A classification of them has been recently given (in 1883) in a volume entitled, "Classification of the Coleoptera of North America," by Drs. LeConte and Horn. Not only does this volume afford to the American student the needed facility for his study, but so admirably does it embody and present the fruits of the life-labor of one who was peculiarly fitted for the work—Dr. LeConte, whose recent death we mourn—that the new system of classification and order of sequence therein presented, marks so great an advance upon previous systems that it can hardly fail of being accepted by the scientific world.

The attractiveness of the butterflies and moths constituting the order of Lepidoptera, as well as the economic importance of their larvæ in their dependence for a food-supply so largely upon the crops which are deemed essential to our existence or comfort, have long made them favorite objects of study. About five thousand species have been described.

The butterflies have been carefully studied and largely illustrated in their several stages. A volume given to the public the present year, prepared by Prof. French, of the Southern Illinois Normal University, for the use of classes in zoölogy and private students, under the title of "The Butterflies of the Eastern United States" (all that region lying east of Nebraska, Kansas and Texas), enables the student, by the aid of synoptic tables, simple descriptions and excellent figures, to identify almost any butterfly pertaining to this Atlantic zoö-geographical province. Of the moths (all of the Lepidoptera not butterflies), several families, as the *Sphingidæ*, *Bombycidæ* and *Geometridæ*, have been given good illustration, and all have been advanced through the enthusiastic labors of special students.

While striving to avoid irrelevant detail in this paper, it would not be proper, even in so cursory a reference to scientific labor richly deserving many pages for its simple record, to omit mention of the debt we owe, for a very respectable knowledge of our Diptera (flies, gnats, etc.), to Baron von Osten Sacken, for a long time a member of the Russian Legation at Washington, and to his friend Dr. Loew, of Prussia. And, as we recall the "Synopsis of the Neuroptera of North America," and several other kindred

publications not much less extensive, which give us about all that we know of our dragon-flies, May-flies, caddis-flies, etc., we can not forego mention of the name of Dr. Hermann Hagen, the highest living authority in this order, long distinguished in Prussia as one of the leading entomologists of Europe, but many years ago induced by Louis Agassiz to transfer his labors to this country under the temptation of an unexplored Neuropterous fauna, together with the opportunity for its study in a life-professorship at Harvard University.

Commendable progress has been made in the study of the Orthoptera, of which grasshoppers and crickets are representatives, through the attention given to the order by Mr. Scudder during a long term of years, and later by the members of the United States Entomological Commission in their investigations of the Rocky Mountain locust and allied species. A synopsis of the *Acrididæ* (grasshoppers) has been published, but some of the families have not been catalogued. To the kindness of Mr. Scudder I am indebted for an estimate of 450 described species of North American (north of Mexico) Orthoptera, of which 275 are Acridians.

In the Hemiptera (plant-lice, scale-insects, cicadas, plant-bugs, etc.), far less progress has been made than with the same order in Europe. Collections and descriptions, however, have advanced to the extent of permitting the publication of a catalogue. The first part of a catalogue, embracing the suborder of Heteroptera, of which the plant-bugs are typical, has recently been published, giving the names of 1,450 species, while the remaining suborder of Homoptera is in preparation.

NUMBER OF DESCRIBED INSECTS.

A comprehensive idea of present acquaintance with our insect fauna, so far as relates to the forms we have to deal with, may be obtained from the following statement:

Dr. Packard, well known from his extensive writings as a leading entomologist, has estimated (although somewhat roughly) that there are within the limits of the United States 50,000 species of insects.* Of these there are at least (we can not give the precise number, as some of the orders are still uncatalogued) 25,000 described species.†

LITERATURE OF THE SCIENCE.

The literature of American Entomology has become so voluminous that a good working library for a student whose studies embrace all the orders of insects, would contain at least five hundred volumes, and this would need to be supplemented by the privilege of access to some public library where would be found other works needed for occasional reference—not one so barren of scientific publications as our State library, whose catalogue (subject-index) gives but eighty-five entomological titles.

Unfortunately, much of the literature, the more recent, and, therefore, the more desirable, is scattered through the publications of scientific societies, government reports, reports of agricultural and horticultural societies and agricultural papers.

Government Publications.—The knowledge of our insects has been greatly promoted through the liberality of the general government in the large number of valuable publications that have been issued and distributed gratuitously by the Department of Agriculture, the Department of the Interior, and the Engineer Department of the Army.

Smithsonian Institution Publications.—The kindly aid extended by the Smithsonian Institution has proved of incalculable service. Several of the monographs which have contributed so largely to the advance in this department of science owe even their

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* Hayden's Ninth Annual Report of the United States Geographical and Geological Survey of the Territories for 1875. Washington, 1877, page 590.

† In the several orders as follows: Lepidoptera—Butterflies (Edwards List, 1884), 614. Moths (Grote Check List, 1882), 3,184. Tineidæ, not included by Grote (Chambers List, 1878), 779. Diptera (Osten Sacken estimate in 1878), 2,500. Coleoptera (Henshaw List of 1885), 9,507. Hemiptera-Heteroptera (Uhler Check List, 1886), 1,448. Hemip.-Homoptera (Uhler estimate), 1,200. Orthoptera (Scudder estimate), 450. Hymenoptera and Neuroptera combined, at least 5,500.

preparation to special requests made by the institution, and to material in considerable part supplied from its collections. We are indebted to it for twenty-two valuable publications on insects.

Serials.—Prompt description of new species, of observations of interest, or of special studies, obtain ready publication in the four serials* (two monthly) that are devoted to current literature. Sixty-three volumes of serials have been issued, including the Canadian Entomologist, published in London, Ontario, with contributors mainly from the United States.

BIBLIOGRAPHY.

The aid in any department of study afforded by proper bibliography is appreciated by every student. The entomological student is fortunate in having probably the most complete bibliography ever prepared of any branch of natural history, in the "Bibliotheca Entomologica" of Dr. H. A. Hagen. The labor involved in a work of this scope, may be appreciated when we state that it was eight years in compilation, involving visits to all the principal capitals and libraries in Europe, and that eight hours a day for three years was devoted to its proof-reading. It embraces all entomological books and papers issued from the earliest times to the year 1862, the time of publication—18,130 in number, by 5,617 authors. From the year 1874, an annotated biographical record of all writings upon American insects has been given in Psyche. It is now appearing in the form of title-slips which may be used as card catalogues, and has reached the current number of 3884.

A bibliography of American Economic Entomology is now in course of preparation by Mr. P. Pickman Mann, of the Entomological Division at Washington, which contains at present about twenty-eight thousand manuscript cards, with the compilation, perhaps, not over half completed.

LIFE-HISTORIES OF INSECTS.

A knowledge of the life-histories of the insects of a country, may properly be taken as a measure of its progress in the science, for such knowledge must ever afford the basis for advancement in the right direction. In the applications of the science to protection from insect injury, it is indispensable, for until we have learned the several phases that insects assume—their habits, their environments—we do not know how, when, or where they may be most effectively attacked. To our economic entomologists, therefore, particulary to Dr. Fitch and Prof. Riley, are we indebted for the possession of full life-histories of a large number of our injurious species. Some of the histories that have been given us, in their faithfulness, fullness, details and illustration, might serve as models for all similar work. Special mention deserves to be made of the admirable life-histories of our butterflies, published by Mr. W. H. Edwards, in his two quarto volumes (a third in preparation) of the "Butterflies of North America." No other country can boast of such a series, so laboriously studied, so elaborately given, and so beautifully illustrated.

But in a knowledge of the early stages of our insects, generally, we are much behind European advance. Thus, we may know the larval form of one-fifth of our lepidoptera; in Europe about four-fifths are known, together with their food-plants. Of our coleoptera, the larvæ of only about two per cent of the named species have been described, although quite a number are in collections awaiting description and proper illustration.

ANATOMICAL STUDIES.

The studies of the anatomy of insects have been numerous, and, from their ability, have added much to the biological knowledge of this class of the animal kingdom. Among the many names associated with this advancement may be mentioned those of Packard, Scudder, Hagen, Burgess, Geisler, Minot, Mark, Dimmock, Leidy, Wyman, and Chambers.

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*Transactions of the American Entomological Society, Psyche, Entomologica Americana, and the Canadian Entomologist.

In a recent paper upon the "Systematic Position of the Orthoptera in relation to other Orders of Insects," illustrated by forty plates, Dr. Packard has given an abstract of the results of the examination of the external anatomy of a larger number of forms including, also, Pseudoneuroptera and Neuroptera, than had ever before been brought together. He proposes to modify our general seven order classification by separating the Pseudoneuroptera from the Neuroptera, and Dermatoptera (consisting of a single aberrant and perplexing genus, *Forficula*) from the Orthoptera. This modification, together with a change made in the last edition of his "Guide" in the elimination of Thysanura — a low group of wingless forms showing myriapod features — would give the following sequence of orders: 1. Thysanura; 2. Dermatoptera; 3. Orthoptera; 4. Pseudo-Neuroptera; 5. Hemiptera; 6. Neuroptera; 7. Coleoptera; 8. Diptera; 9. Lepidoptera; 10. Hymenoptera.

Although the Thysanura are so degraded a group in development, it is honored by Dr. Packard with possessing a hypothetical form ("a lost type") in which he suggests that all of the million of species of insects now peopling the globe may be supposed to have had their origin.

Histological Studies.

Histological studies, consisting of observations of the powers, peculiarities and modifications of the cells that form the tissues of the animal kingdom (as also of the vegetable), and outside of which no life exists, are no longer confined to the medical profession, but have been earnestly entered upon by the zoölogist. Until recently, histological study of our insects has been neglected, but it may now be regarded as fairly commenced, with every promise of its successful prosecution.

Some valuable studies have lately been made by Dr. Charles Sedgwick Minot, among which may be specially cited his "Histology of the Locust," as given in the Third Report of the U. S. Entomological Commission, in sixty pages and fourteen plates, seven of which are devoted to the brain of the locust.

For other contributions we are indebted to Dr. Packard and Dr. E. L. Mark.

Embryological Studies.

Contributions of much value to the embryological history of insects have been made in this country, which will compare favorably with those of the German schools. Among several others worthy of particular mention are those of Dr. Packard upon some species of dragon-flies, the currant-worm, the locust, and some coleoptera and hymenoptera. An incentive to these studies has been the hope that they might furnish a safe and satisfactory guide in classification, but up to the present they have failed to yield any infallible data. Another incentive should be found in the facility of study afforded in the often transparent egg-envelope of the insect, and in the rapid development of the embryo — in the house-fly, *Musca domestica*, a period of only twenty-four hours. Additional inducement is offered in the idea that has been advanced, that the embryological development of an insect should present the series of changes through which it has passed in its evolution from the first hexapod to the rank that the species now holds, i. e., that the egg should furnish an epitome of ancestral history. But this has not been realized. The summary, as presented, is too condensed, and has been, it is claimed, too greatly influenced by a natural tendency to variation, and readiness of adaption to conditions. Much that is sought for is not to be seen. Missing links mar the continuity, as in the evidences of the rocks. And there will always be "missing links" in the chain of evolution with which it is sought to bind all living forms, and all that have had life, to the primordial nucleated cell — itself "evolved from inorganic matter through electro-chemical force."

Economic Studies.

The study of insects in their relations with man — of their character, habits, transformations, food-plants, enemies, diseases, etc., — with a view of affording protection from the excessive ravages of a large portion of their number, or of utilizing the benefits that some may subserve — is what is understood as economic entomology. In this

particular department we are able to report rapid recent progress, and an advance quite beyond that attained in any other country. For this there are two reasons:

First.— The study is a necessity for us. In no other country are agricultural products subjected to depredations so great as in the United States — a condition resulting from the introduction of a large number of the most injurious insect pests of Europe unattended by their natural parasites, and from the multiplication of species and individuals through the large areas devoted to special crops, as fruit orchards of five hundred acres, and wheat fields of from twenty-five to thirty-five thousand acres.*

Second.— State and National aid extended to the study. Nearly fifty years ago (in 1837), we find unequivocal recognition of the policy of the State in providing for investigations of this nature, in the instructions by Governor Edward Everett, of Massachusetts, under which that invaluable "Treatise on Insects Injurious to Vegetation," was prepared by Dr. Harris. In them we read as follows: "It is presumed to have been a leading object of the Legislature, in authorizing this survey, to promote the agricultural benefit of the Commonwealth, and you will keep carefully in view the economical relations of every subject of your inquiry. * * * the promotion of comfort and happiness being the great human end of all science."

The example of Massachussets was followed by New York in 1853, in directing and providing for the investigations of Dr. Fitch, which were so ably continued through a long term of years. To the high estimation in which these reports were held, and the practical results attending them, we are indebted for the subsequent investigations and reports of the State entomologists of Missouri and of Illinois, which have been of a high order. Forty State reports on injurious insects have appeard.

An entomologist (Mr. Glover), had been connected with the Department of Agriculture at Washington since 1863, by whom annual reports were issued, but with his study of insects, many other official duties were connected. In 1878, in recognition of the growing importance of the study, an Entomological Division was established, organized for efficient work with a chief and assistant, and facilities for ample illustration and publication given it. From that time to the present, the work of the Division has continued to increase in magnitude and importance. Appropriations were made for it the last year, inclusive of a special appropriation for the encouragement of silk-culture in the United States, of $40,000. With such means at its command it has been able to make thorough studies of a large number of our insect pests; special scientific study of certain little known groups (as the *Coccidæ*, *Chalcididæ*, etc.); of the insect enemies of the cotton, wheat, hops, and other crops; and to publish these investigations in an annual report, having an edition of four hundred thousand copies,† and in bulletins and otherwise.

But the labors of this Division which have particularly contributed to the advancement of economic entomology have been those for the discovery of the most efficient materials for use in the destruction of insects, known as insecticides, and in mechanical devices for their application. Of the former, are arsenical poisons, pyrethrum, kerosene emulsions, and bisulphide of carbon; of the latter are various spraying pumps, nozzle-forks for under-spraying the cotton-plant, eddy-chambered nozzles, cyclone nozzle, centrifugal throwers, bamboo-hose extension pipes for spraying tall trees, and other like devices in bewildering nomenclature. At the late World's Centennial Exposition at New Orleans, 117 implements for the application of insecticides, either in powder or spray, were exhibited by the Entomological Division, ranging from the simple powder-bellows for household use, to a complicated field atomizer in which the agitating and distributing machinery is operated by the wheels of the cart upon which it is drawn as it scatters its impalpable spray over nine rows of cotton at once.

Additional appropriations have also been made by Congress of $10,000 and $15,000 a year, for the investigations by a special commission of the Rocky mountain locust, the cotton-worm, and a few other insects, whose ravages were so extended as to assume a

* First Report on the Insects of New York, 1882, pp. 8, 11. † At a cost of at least $20,000.

national importance. The commission has given us the result of its labors in four large octavo volumes (a fifth is in preparation) and in seven bulletins which more than equal another volume in size.

Entomological Societies.

The establishment of entomological societies has contributed much in stimulating the study of our insects. The first society, under the name of the Entomological Society of Pennsylvania, was established at Baltimore in 1842. It would seem to have been a premature organization, resulting in the publication of no papers, probably in the presentation of none, and with a membership that never exceeded the requirements of official duties.

At the present there are four societies in active operation in the United States, and one in Canada; established at Washington, Philadelphia, Brooklyn, Cambridge, Mass., and London, Ontario.* Each of these is issuing publications and has its library and collections. There is also an entomological club connected with the American Association for the Advancement of Science, holding an annual series of meetings for the presentation of papers and for general discussions.

It is indicative of interest and efficient labor that American entomologists are sustaining an equal number of societies with our European collaborators, there being five n Europe—of London, Belgium, France, Italy, and Russia.

Entomological Collections.

Several large collections of insects have been brought together in this country, which fully meet the purpose for which collections in natural history are made, viz.: An exhibition of the fauna, more reliable means of naming new material than from published descriptions, preservation of types, opportunity of comparison of native forms with those from other parts of the world, and access to ample material needed for monographic work.

Prominent among the general collections may be mentioned those of the National Museum at Washington, the American Entomological Society at Philadelphia, and that of the Museum of Comparative Zoölogy at Cambridge, Massachusetts. The last named is the boast and pride of the American student. In it is contained, with every possible appliance for protection from harm, the collection of Coleoptera which represents the life-labors of Dr. LeConte, and rich with its 4,000 type specimens; Baron von Osten Sacken's collection of 2,500 Diptera, including his types and those of Dr. Loew; Chambers' collection of *Tineidæ;* the collection made by the Essex Institute of Salem, Massachusetts; and types of Zeigler, Melsheimer, Say, and others. But its chief attraction is in its biological collection, in which illustration is given, more or less full, of the natural history of above 5,000 species, in their several stages of development, their characteristic depredations, food-plants, architecture, diseases, the parasites that prey upon them, etc. No other collection of the kind in the world surpasses it, if, indeed, any equals it.

A collection limited to a single order of insects, the Lepidoptera (butterflies and moths), is to be found in Reading, Pa., which is probably the largest ever brought together by a private individual. It has been made by Mr. Herman Strecker, and has attained its present magnitude and value through many years of labor, of privation, and an enthusiastic zeal which has known no limit short of full representation of all American forms, and the possession of the most rare and desirable of exotics of the several continents and islands of the sea, so far as they have been procurable, regardless of their cost. Something of an idea of its extent may be had from the statement that it occupies 600 closely packed drawers of the ordinary German museum size, 16x20, seventy of which are devoted to a single genus of butterflies—*Papilio*, of which our large yellow swallow-tail may be cited as type. The number of named and classified specimens is said by its owner to exceed 70,000.

* Entomological Society of Washington, American Entomological Society, Brooklyn Entomological Society, Cambridge Entomological Club, and the Entomological Society of Ontario.

ENTOMOLOGICAL LIBRARIES.

A reference to some of the entomological libraries of the United States should be of interest as showing the aid found necessary or desirable to our students in the prosecution of their studies.

The first in importance is that of the Museum of Comparative Zoölogy at Cambridge, Massachusetts, having assumed that rank from the incorporation with it of the private library of Dr. Hagen. It is rich in works on Neuroptera, in Bibliography, and in anatomical, physiological and biological papers. It is judged to contain about 2,000 volumes and 3,000 pamphlets.

Harvard College library contains about 450 volumes.

The Public Library of Boston has about 650 volumes, nearly all standard works and but few pamphlets.

The Boston Society of Natural History reports about 900 volumes and 550 pamphlets. About one-third of these formerly constituted the private library of Dr. Harris.

The Astor Library of New York has about 500 volumes.

The Buffalo Society of Natural Sciences has over 500 volumes and about as many pamphlets.

The library of the American Entomological Society at Philadelphia is said to consist of 1,728 volumes, inclusive of some general works but in part relating to entomology.

The Academy of Natural Sciences of Philadelphia, 956 volumes and 554 pamphlets.

The Peabody Institute at Baltimore, over 800 volumes.

Of private libraries may be mentioned the following: That of Mr. Scudder, of 765 volumes and nearly 2,000 pamphlets, rich in works on the Orthoptera, butterflies, fossil insects, and the anatomy and embryology of insects.

Professor Riley's library contains about 700 volumes and 3,000 pamphlets, largely of biological and economic publications.

Dr. LeConte's library, which has been scattered since his death, was mainly in Coleoptera, and contained 700 volumes and 800 pamphlets.

Dr. Packard's library, of 470 volumes and 500 pamphlets, has a special value in its embryological and morphological works.

Mr. Uhler's library, selected with special reference to his studies of the Hemiptera, contains over 300 volumes and 500 pamphlets.

The above items are drawn from a publication by Mr. Scudder in 1880, entitled "The Entomological Libraries of the United States." Since its compilation, large additions have doubtless been made to each one of the libraries.

PALÆONTOLOGICAL ENTOMOLOGY.

Notwithstanding the abundant wealth of our insect fauna, ever yielding discovery of previously unknown forms, while unnamed and unclassified material is an embarrassment in all of our large collections, the ancestors of these myriad forms have not been permitted to lie neglected in the beds of rock that have held their forms for countless ages. The discovery, several years ago (in 1867), in the Rocky mountains, of beds of fossil insects of unsurpassed richness, has given both the opportunity for, and the impetus to, their study. During the past twenty years Mr. S. H. Scudder has devoted much time to the fossil insects occurring in the Devonian rocks of New Brunswick, and in the carboniferous, triassic and tertiary beds of the western States and territories, as may appear from a list of sixty-four publications upon these and European forms, published by him up to 1882. Some tertiary beds of a lake basin at Florissant, in Colorado, have proved far more prolific of insect remains than any others in the world. About 12,000 specimens have been taken from them, representing each of the general seven orders of insects, while hundreds of thousands have been left behind. Among them was the first fossil butterfly ever found in America (nine were known from the tertiaries of Europe), and the most perfect one ever found. It is described as "in a wonderful state of preservation, the wings expanded as if ready for the cabinet, and

absolutely perfect, with the exception of a small angle of one wing. The antennæ are nearly perfect. The markings of the wings are perfectly preserved, and in portions of the surface the form of the scales can be determined with the miscroscope."

Entomology in our Schools.

I regret that I have to report that entomology has not been given the place in our schools that it deserves. In our State, the Albany Normal School and the Oswego Normal School have given excellent instruction in it—in the latter united with laboratory work. Cornell University sustains a professorship in entomology, with courses of lectures, a laboratory, a large named and classified collection, and a library so rich in its serials that every entomological journal published in the world finds place in it. In some of our public schools occasional talks are given upon insects when teachers may chance to have a taste for the study. Elsewhere, lectures upon entomology are given in course at Harvard University, the State College of Maine, the Michigan State Agricultural College, Purdue University at Layfayette, Ind., the Illinois Industrial University, the Iowa Agricultural College and the Kansas State Agricultural College. In each of the State institutions, particular attention is paid to the economic aspect of the science. In some of the common schools of California the science is taught and collections are made by the pupils, in consideration of the interest lately aroused by the great increase of fruit insects in that State.

The above, with the exception of some academic instruction in other States, is the sum, so far as known to me, of what is being done in our institutions of learning in this department of science.

Will you pardon me if I go beyond the scope of my topic, to enter a protest against this neglect of the study? Its importance, viewed from a utilitarian standpoint alone, as might easily be shown, entitles it to a reasonable share of attention. Compare it, if you please, in practical importance, with the study of botany, which has become so popular in our schools. Some idea of its importance may be obtained from the statement that careful computations, based upon the census returns of the agricultural products of the United States, show annual losses to these products of two hundred millions of dollars, a large proportion of which are preventable. In interest, nothing in the range of natural history can equal the study of the wonderfully varied habits of insects and their marvelous transformations. As a mental discipline, it is fully equal to the study of the classics, in its stimulation of the powers of observation, comparison, discrimination, memory, while it tends to promote habits of study, industry, delicate manipulation, order, neatness, and precision, which can not but prove of service in any occupation or position in life.

Have we the text-books for school instruction, such as are found in other branches of natural history—in botany, for example? No, we have not; nor can we have, nor are they needed. The synoptic tables and brief descriptions that would be required for the identification of our United States species, with only twice the space devoted to an insect that is given to a plant, would occupy, as I have computed, forty volumes of the size of Gray's School and Field Book of Botany. But identification of species is not the end of entomological study. With "Packard's Guide to the Study of Insects" in the hands of the teacher, and with such assistance as would be suggested by it, he could soon prepare himself to give better instruction than that usually obtained from text-books alone. No branch offers such facilities for object-teaching. The objects are almost innumerable—they cost nothing—they even come to you unsought. You could take one hundred species of flies alone from your window-panes. Surely, there is no valid reason for not introducing at once this study in our schools.

Is it *right*, I would ask, in passing, and I use the word in its full import as antithetical to wrong, that the 283 academies and academical departments in our State should be able to report but fifty-one of their number as giving instruction in zoölogy—less than one-fifth? And yet this is the study that would teach of those wonderful organisms, instinct with life and intelligence, associated with us upon a globe in which the adaptations to their wants are as perfect as for our own, and each with a structure in which God is revealed as unmistakably and as clearly as in the structure of the universe.

In closing this sketch, quite imperfect from the brief time that could be devoted to it, I desire, Mr. Chancellor, to express to you and to your Honorable Board the obligations and the gratitude of American entomologists for the encouragement that for so many years you have continued to extend to this department of study. The resumption, a few years ago, of economic studies under State authority and provision, after a long intermission, was largely owing to your instrumentality, and to your recognition of their usefulness in the promotion of the agricultural interests of the commonwealth and of the country.

[From Entomologica Americana, ii, 1886, pp. 143-160.]

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL CLUB OF THE A. A. A. S.

(Read at the Buffalo Meeting of the American Association for the Advancement of Science, August 17, 1886.)

GENTLEMEN.—I do not know that I can better discharge the duty devolving upon me, of the presentation of an address on this occasion, than in reference to some of the evidences of the continued progress made in our department of science, as shown in publications which have appeared since our last meeting. Little that I shall refer to, may be new to most of those present, yet a retrospect of labor satisfactorily performed and successfully prosecuted, is always agreeable to those who have had part therein, while it may prove of interest and of value to those who are not present with us, or active members of our corps, or who may not have access to our current literature.

Each of the several Orders of insects has been advanced through valuable studies and publications. While in some of the orders, the publications have been but few, yet it is gratifying to know that collections are being made in them and studies prosecuted, of which we may look for the results ere long.

PUBLICATIONS IN THE SEVERAL ORDERS OF INSECTS.

In the *HYMENOPTERA*, a *Monograph of the Chrysididæ* has been published by Mr. S. F. Aaron, containing diagnostic descriptions of genera and species. Seventy-four species are described, over one-half of which are new to science: nearly all are contained in the collections of the American Entomological Society, of which Mr. Aaron is the curator. A list of the more important writings on the *Chrysididæ* is appended, and the paper is illustrated in five plates (Transactions of the American Entomological Society, xii, 1885, pp. 209-248).

Mr. Wm. H. Ashmead has given a *Biographical and Synonymical Catalogue of the North American Cynipidæ*, containing 172 species, together with a list of the trees and plants upon which they occur. It appears that these insects are so nearly confined to oaks (of the twenty species of oaks enumerated), that only thirteen species have other food-plants (Id., ib., pp. 291-304).

From the same author we also have *Studies on North American Chalcididæ*, giving descriptions of twenty-five new species from Florida and notes upon others (Month. Proc. Am. Ent. Soc., for Dec., 1885, pp. x-xix; Trans. A. E. S., xiii, pp. 125-135).

Mr. L. O. Howard, of the Entomological Division of the U, S. Department of Agriculture, who for several years past has been engaged in the study of the interesting and serviceable family of the *Chalcididæ*, is contributing to Entomologica Americana, a generic synopsis of the family, which he has divided into twenty sub-families. The European genera have been combined with our own, as many of them will doubtless be hereafter detected in this country (Ent. Amer., i, pp. 197-199, 215-219, ii, 33-39, 97-101). A list of the North American species by Mr. Howard, may be found in Bulletin No. 5 of the Division of Entomology, which also embraces the first of a series of papers descriptive of the Chalcididæ in the collection of the Department, most of which were previously undescribed.

Contributions to the knowledge of our Hymenoptera have also been made by Messrs. G. J. Bowles (Canadian Entomologist, xvii, p. 231); J. A. Guignard (id., xviii, p. 68); Wm. H. Harrington (id., pp. 30, 38, 45, and in Trans. No. 6 of Ottawa Field-Naturalists' Club, p. 244); G. W. Taylor (Canad. Ent., xvii, p. 250), and T. W. Fyles (id., xviii, p. 38).

We are greatly pleased to learn that Mr. Ezra T. Cresson, to whom we are more largely indebted than to any other person for the knowledge of our North American Hymenoptera, is engaged upon a Synopsis of the order, and that such progress has been made in its preparation that its publication may be expected before many months.

In the *LEPIDOPTERA*, a volume has been given to the public the present year, which we hope will be followed by others of the kind, in other of the orders, that greatly needed wants may be met.

The Butterflies of the Eastern United States, for the use of classes in Zoölogy and private students, by Professor G. H. French, of the Southern Illinois Normal University, will enable the intelligent student, by the aid of synoptic tables, descriptions and figures, to name almost any of the species that occur within the United States, east of Nebraska, Kansas, and Texas. Two hundred species are described, illustrated by ninety-three figures, and where known, the earlier stages are also given.

A similar work, devoted to a smaller group, is the *Sphingidæ of New England*, by Professor C. H. Fernald — a pamphlet of eighty-five pages and six plates, in which the forty-two species known to occur in the Eastern States are described and a few of them figured.

A feature in both of the above publications which deserves special commendation, is the accentuation of the binomial name of the species. The care that has been bestowed upon the preparation of these lists, entitles them to acceptance and adoption, and we hope will ensure us some degree of uniformity in pronunciation, hereafter.

Professor Fernald and Mr. Jno. B. Smith have contributed notes upon *Some of the Genera of our Sphingidæ* (Entomologica Americana, ii, p. 2).

Mr. Smith has continued his *Introduction to a Classification of the North American Lepidoptera*, in a fourth paper, devoted to the Sphingidæ (id., i, pp. 81-87), and has also given a more detailed account, with illustrations, of the scent-organs in some Bombycid Moths, than we have hitherto had (id., ii, p. 79).

The careful Life-histories of our Butterflies have been continued by Mr. W. H. Edwards (Canad. Ent., xvii, pp. 155, 181, 245), and also his Description of New Species, from the Pacific Slope (id., xviii, p. 61).

The Rev. G. D. Hulst has published during the last month, *Descriptions of New Pyralidæ*, embracing such species as are not named in the American collections and are unknown to those who have made special study of the family. Much the larger number of the species described (89 in all) are from the western portion of the United States (Trans. Amer. Ent. Soc., xiii, July, 1886, pp. 145-168). Mr. Hulst has also published two papers upon the *Geometridæ* in which several new species are described, viz., *New Species and Varieties of Geometridæ* (Ent. Amer., i, pp. 201-208) and *Notes upon Various Species of the Ennominæ* (id., ii, pp. 47-52).

Descriptions of new species of Lepidoptera have also been published by Mr. Henry Edwards (Ent. Amer., i, p. 128, ii, p. 8), Mr. J. Elwyn Bates (Can. Ent., xviii, 74, 94), Mr. Ph. Fischer (id., xvii, p. 133), Mr. B. Neumoegen (Ent. Amer., i, p. 92), and Mr. R. H. Stretch (id., ib., p. 101).

In the Proceedings of the Natural Science Association of Staten Island, for March, 1886, Mr. Davis has recorded sixty species of butterflies as found upon Staten Island, naming the recent additions to a former list.

Other contributions to the Lepidoptera have been made by Messrs. Beutenmüller, Bates, Clark, Fischer, Fletcher, French, Goodhue, Grote, Hamilton, Harrington, Kellicott, Moeschler, Smith, Stretch, Tepper, and Mrs. C. H. Fernald, and Miss Murtfeldt.

It is gratifying intelligence that the two volumes of the *Butterflies of North America*, for which we are indebted to Mr. W. H. Edwards, is to be followed by a third work upon which has been commenced. As the volumes already issued have furnished the American student with a better series of life-histories of butterflies than have ever been pub-

lished elsewhere, while enriched with illustrations which in beauty and accuracy have never been surpassed, it is to be regretted that their author should be compelled to find the reward for his years of untiring labor in the honor that they may bring him, and not in a pecuniary return. A merited tribute to the high character of this work may be found in Science, for October 9, 1885 (p. 307).

The *Butterflies of New England*, which has been under the pen and pencil of Mr. S. H. Scudder for several years, and which has been so long awaited by entomologists, is, we learn, rapidly approaching completion. Having had the privilege of examination of several of the plates which are being printed at the well-known house of Sinclair & Sons, Philadelphia, by the chromo-lithographic process, I may say of them, that they are marvels of faithfulness and beauty, hardly to be distinguished from hand-coloring. They certainly mark an advance in the application of this art to insect illustration that has never before been equalled in this country or in Europe.

A *Hand-book of all the Lepidoptera described as belonging to the North American Fauna, North of Mexico*, giving brief descriptions of all the species known, to be illustrated with wood-cuts and lithographic plates, under the editorship of Mr. Henry Edwards, of New York, is announced. It will be issued in parts, by S. E. Cassino, as stated in a circular distributed, and will be commenced as soon as a sufficient number of subscribers can be obtained.

Mr. R. H. Stretch is engaged on a *Monograph of the Zygænidæ, Lithosiidæ and Arctiidæ of North America*, in which it is intended to collate all the literature relating to these families, and to illustrate all the species. About 350 figures have already been drawn for the work.

DIPTERA.— We are unable to report much progress in this Order during the year.

Dr. S. W. Williston has completed his series of three papers on the *Classification of the North American Diptera* in the families *Xylophagidæ, Stratiomyidæ, Tabanidæ, Leptidæ*, and *Syrphidæ*, published in the Bulletin of the Brooklyn Entomological Society (vii, p. 129) and in Entomologica Americana (i, pp. 10, 114, 152). In these papers some new species are described, synoptic tables of the genera and diagnoses of the tribes and families given, and structural features illustrated.

Dr. Williston has also published *Notes and Descriptions of North American Xylophagidæ and Stratiomyidæ* (Can. Ent., xvii, p. 121), in which eleven species are described as new.

Dr. Hagen has written of the *Hessian Fly in Italy*, recording its notice in that country (Can. Ent., xvii, p. 129). He has also collated some facts relating to the food of the larva of *Scenopinus*, leading him to offer the suggestion that *S. pallipes* found beneath carpets, may be carnivorous (id., xviii, p. 73). Some observations of my own which are stated in the 2d Report on the Insects of New York, give additional reason for believing that this remarkable larva, feared as a carpet-feeder, may prey upon the larva of the clothes-moth, *Tinea pellionella* (Linn.).

The volume last referred to, contains also notices of an unknown dipterous larva feeding upon a fungus occurring on quince, the emasculating bot-fly (*Cuterabra emasculator*), *Bibio albipennis*, *Microdon globosus*, and *Trypeta pomonella*.

As addenda to the Scenopinus article by Dr. Hagen, Baron Osten Sacken has contributed to the Entomologist's Monthly Magazine for the present month of August (vol. xxiii, p. 51-52) *Notes toward the Life-history of Scenopinus fenestralis*, in which the literature of the species is more fully developed, and the conclusion drawn therefrom that the larva is undoubtedly carnivorous; and that it frequents fungi, hair mattresses, carpets, swallows' nests, decaying wood, animal dejections, etc., not for the sake of the animal remains or the vegetable matter, but for the larvæ or the pupæ of the moths that live in them.

Dr. Hagen has also recorded the rearing from stored sea-weeds in Harvard College Laboratory, of what is probably an addition to the small number of known marine insects — *Œlopa frigida* Fallen. Its earlier stages are unknown, and the opportunity is taken to call attention to the absence of any collation of our knowledge of the earlier stages of the Diptera (Can. Ent., xvii, p. 140).

In a brief note from the same author to Entomologica Americana (i, p. 229), the idea is advanced that in *Cecidomyia tubicola* Osten Sacken, the larval breast-bone is a spinning organ, and homologous with the labium.

Mr. D. W. Coquillett has monographed the Lomatina of North America of the *Bombylidæ*, consisting of four genera, indicating one as new, and describing five new species (Can. Ent., xviii, p. 81).

COLEOPTERA.—Dr. G. H. Horn has continued to lay us under obligations for his valuable contributions to Coleopterology, in descriptive, classificatory, bibliographical, and critical papers, in the pages of the Transactions of the American Entomological Society, the Canadian Entomologist, and Entomologica Americana. Their titles are too numerous to permit their citation in the present paper.

Lieut. Thom. L. Casey has published *New Genera and Species of Californian Coleoptera* (Extra Bulletin, California Academy of Science, vol. i), and a *Revision of the Californian Species of Lithocharis* (Bulletin No. 5, Id., vol. ii).

Mr. Frederick Blanchard has given a careful paper *On the species of Canthon and Phanæus of the United States*, with synoptic tables of species, bibliography, and notes on some other genera (Trans. Amer. Ent. Soc., xii, pp. 163-172).

Mr. Charles W. Leng is contributing to Entomologica Americana, *Synopses of Cerambycidæ*, accompanied with illustrations (vol. i, pp. 28-35, 130-136; ii, pp. 27-32, 60-63 81-83, 102-103, 118-120, 193-200).

Other contributions to the order, which have come under my notice, are from Messrs. F. B. Caulfield, F. Clarkson, John Hamilton, S. Henshaw, A. W. Jones, Warren Knaus, C. W. Leng, A. S. Packard, E. A. Schwarz, J. B. Smith and C. W. Strumberg.

In Entomologica Americana for July and August, 1886, is a *Record of some Contributions to the Literature of North American Beetles published in* 1885, by Samuel Henshaw, which will be found very convenient for reference, and for which its compiler is entitled to sincere thanks.

The most generally acceptable contribution to this order made during the year, has been the *List of the Coleoptera of North America, North of Mexico*, by Samuel Henshaw, in which we are given the recent classification of Drs. LeConte and Horn, the large number of new species described during the preceding twelve years, together with many important synonymical corrections. Annual supplements to the List are promised by the author. The labor involved in the preparation of a work of this nature is so great, that each successive contribution of the kind, if as meritorious as the one under notice, marks an epoch in the literature of the order.

In the *HEMIPTERA*, we have had the gratification of having placed in our hands, our first Check-List. It presents a classification which has been so long needed by the student, of the Heteroptera, and the names of 1,448 species. A debt of gratitude is due to Mr. Uhler for its preparation, in consideration of the increased facility for study that it will afford, and the incentive that it will prove, to its prosecution.

We have the promise that a similar List of the Homoptera will follow as soon as time can be found for its preparation.

The chapter on Hemiptera, in the Standard Natural History recently published by S. E. Cassino & Co., of 92 pages royal octavo, is also from Mr. Uhler, and has been, I believe, generally received as advancing our knowledge of an order which has been much neglected in this country.

The Fourteenth Report on the Insects of Illinois, by Prof. S. A. Forbes, State Entomologist, treats of several Hemipterous Insects, chiefly in their economic relations.

In the Report of the Entomologist of the U. S. Department of Agriculture for 1885, Prof. Riley has presented a careful study of the two broods of the Periodical Cicada, *Cicada septendecim*—the seventeen-year (*septendecim*) and the thirteen-year race (*tredecim*) which appeared in 1885 over a large extent of the county, and came together in southern Illinois and northern Georgia. There is also a summary of distribution and future appearance of all the broods (twenty-two in number) known to occur in the United States; also a record of experiments made in transferring the eggs of the northern and

southern races of the insects from one portion of the country to the other, as a test of the influence of climate upon the developmental period.

In the Fourteenth Annual Report of the Geological and Natural History Survey of Minnesota, Mr. O. W. Oestlund has contributed a *List of the Aphididæ of Minnesota*, in which seventy-one species are recorded, of which twenty-four species are described as new, and two new genera named.

Among other contributors to the order, are Mr. Wm. H. Ashmead, Prof. E. W. Claypole, and Mr. John J. Jack.

In the *NEUROPTERA*, Dr. Hagen has contributed the European literature of the *Hemerobius dipterus*, of which twenty examples are in collections in Europe, and four, so far as known taken in this country, referring to this species Dr. Fitch's type of *H. delicatulus* (Entomologica Americana, ii, p. 21).

Mr. J. A. Moffat has narrated some interesting habits of a Myrmeleon larva (Canad. Entom., xviii, p. 76).

Two elaborate papers from Dr. Hagen are additions of much importance to the literature of the Pseudoneuroptera. The first is a *Monograph of the Earlier Stages of Odonata* (in forty-three pages), in which forty-eight species in the subfamilies of Gomphina and Cordulegastrina are described (Trans. Amer. Entomol. Soc., xii, pp. 249-291). The second is a *Monograph of the Embidina*, and is apparently one of the most careful and painstaking of the erudite author's publications. Not only is each one of the seventeen species minutely described (six pages in some instances are devoted to a single species) but the history of the family is fully presented together with an extended discussion of its characters with reference to its assignment to its proper systematic position, which is held by the writer to be near the *Termitidæ* (Canad. Entom., xvii, 1885, Aug., Sept., Oct., and Nov.).

Of writings upon the *ORTHOPTERA*, I find only a *List of the Orthoptera of Kansas*, by Lawrence Bruner, and a note on the habits of *Œcanthus*, by E. W. Allis.

A resumé of our knowledge of Fossil Insects has been published by Mr. Scudder, in a volume of 113 pages, entitled *Systematische Uebersicht der Fossilen Myriopoden, Arachnoideen, und Insekten*. It presents an excellent and comprehensive view of our knowledge of these interesting forms, under a systematic arrangement, with definition of groups and abundant illustration. It is understood that it will be republished in this country.

Mr. Scudder is at present engaged upon an extensive work as it will necessarily be, descriptive of the fossil insects taken from the wonderfully prolific locality, the Tertiary Lake Basin at Florissant, in Colorado. It is thought that the first part of this work will be ready for publication the coming year.

The contributions to which we have referred in the several Orders, have been descriptive, classificatory, historical, biological, histological, anatomical, and biographical. It would perhaps have been more satisfactory if these several departments of study could have been separately reviewed, but the time has not been found for such presentation.

PUBLICATIONS IN ECONOMIC ENTOMOLOGY.

In consideration of the practical importance of economic investigations, will you permit me to direct your attention to some of the work done in this direction, which has been given to us during the year:

The Fourteenth Report on the Noxious and Beneficial Insects of Illinois, by the State Entomologist, Prof. S. A. Forbes, is devoted to the consideration of various insects infesting corn, wheat, grass, clover, the maple, the elm, garden-crops, and orchards. A valuable appendix to this report is a general index to the first twelve Illinois reports — in three parts, viz., of the species of insects alphabetically and systematically arranged, their food-plants, and the remedies treated of.

The *Report of the Entomologist of the U. S. Department of Agriculture, Prof. C. V. Riley*, for the year 1885, presents us with the latest information upon progress in Silk Culture in the United States; an extended notice of *Cicada septendecim;* and notices of recent injuries by five other species of insects. Addenda to this report are the following: Report on the Locusts of the San Joaquin Valley, Cal., by D. W. Coquillett; Report on

the abundance of the Rocky Mountain Locust, in 1885, by Lawrence Bruner; Notes on Locusts at and about Folsom, Cal., by Albert Koebele; Insects Infesting Fall Wheat, by F. M. Webster; Third Report on the Cause of the Destruction of the Evergreen and other Forest Trees in Northern New England, by A. S. Packard (the lepidopterous insects); and Report on Experiments in Apiculture, by N. W. McLain.

The *Second Report on the Injurious and other Insects of New York*, by the State Entomologist (279 pages), embraces notes of various insect attacks; remedies and preventives for insect attacks; miscellaneous notes; and notices of Lepidoptera, Coleoptera, Hymenoptera, Orthoptera and Neuroptera. In the Appendix is a list, with notes, of the miscellaneous publications of the Entomologist for the years 1882 and 1883, and republication of the rare paper of Dr. Fitch on the *Winter Insects of Eastern New York*.

The *Report of the Entomologist to the Department of Agriculture of the Dominion of Canada*, by James Fletcher (56 pages), is occupied with notices of the principal insect attacks during the year 1885, upon cereals, hay and clover, vegetables, fruits, and forest and shade trees.

A *Report upon Orange Insects* (227 pages) presents the investigations of Mr. H. G. Hubbard, a special agent of the Entomological Division of the U. S. Department of Agriculture, made in Florida, during the years 1881-5. The entire insect fauna of the orange, so far as known, is given, and the species discussed, together with the remedies and preventives which have been found to be the most effective in their destruction. The orange-rust is also considered, and is regarded as a condition of the fruit resulting from the attack of the rust-mite, *Typhlodromus oleivorus* Ashmead.

Bulletin No. 11, *of the U. S. Department of Agriculture, Division of Entomology* (34 pages), is devoted to Experiments on various insecticidal substances, chiefly upon insects affecting garden-crops, made under the direction of the Entomologist, by F. M. Webster, H. Osborn, and Thomas Bennett.

Bulletin No. 9, of the same Division, just issued, is entitled, *The Mulberry Silk-worm, being a Manual of Instructions in Silk Culture, by C. V. Riley, M. A., Ph. D.* It is a revised and enlarged edition of Special Report No. 4 of the Division, which had been exhausted. It contains sixty-two pages, a glossary of terms used, twenty-nine figures, two plates in chromo-lithograph showing silk-worms affected by pebrine and flacherie, and the pebrine corpuscles, after Pasteur, and an index.

Bulletin No. 12 of the same Division, also just issued, is entitled *Miscellaneous Notes on the Work of the Division of Entomology for Season of* 1885, *prepared by the Entomologist.* It is a pamphlet of 46 pages and 1 plate, and contains a Report on the Production and Manufacture of Buhach, by D. W. Coquillett, which is full and of much value; Additions to the 3d Report on the Causes of the Destruction of the Evergreen and other Forests in Northern New England, by A. S. Packard; The Periodical Cicada in Southwestern Indiana, by Amos K. Butler; and Notes of the year, of various Insects.

The *Fourth Report of the U. S. Entomological Commission, on the Cotton Worm*, by Prof. C. V. Riley, is a volume of 546 pages, carefully indexed, and illustrated by 64 plates. Of these, 48 plates and 137 pages are devoted to the mechanical devices for the destruction of the cotton-worm. The three chapters treating of the remedies and preventives employed in coping with this insect (70 pages), are especially valuable to the agriculturist, as many of them would be equally available against other insect attacks.

The four large octavo volumes of the Entomological Commission, and its seven Bulletins, of nearly 3,000 pages in the aggregate, 150 plates, several hundred wood-cuts, and a number of maps, may confidently be appealed to in justification of the action of the General Government, if its wisdom be questioned, in authorizing and providing for the work of the Commission now brought to a close in its final publication.

Prof. Riley, in his *Presidential Address before the Entomological Society of Washington*, as published in the Proceedings of the Society, has referred to some of the insect attacks which had recently come under his observation.

An *Address upon Horticultural Entomology* (23 pages), by Prof. F. M. Webster, before the Indiana Horticultural Society, very clearly presents the importance of insect studies to the horticulturist, who may not to any great extent ward off insect attack by the means

successfully resorted to by the agriculturist—by rotation of crops. It also gives comprehensive notice of several of the more injurious insects with which the horticulturist must contend.

The same author has also issued a carefully prepared illustrated paper, of 36 pages, on the *Insects affecting the Corn Crop*, extracted from the Indiana Agricultural Report for 1885. Of the fifty species of corn insects noticed, several are accompanied with useful bibliographical lists.

Insects Injurious to the Apple, is the title of a paper, by Prof. B. F. Koons, extracted from the Report of the Connecticut Board of Agriculture, for 1885. The claims for the study of entomology are well presented in it.

A paper upon *Cut Worms*, read before the New York State Agricultural Society (pp. 25, figs. 20), and one entitled *Some Injurious Insects of Massachusetts*, read before the Massachusetts State Board of Agriculture, by the State Entomologist of New York, have been published in the annual reports of the societies named, and also as separates.

The Fourth Report of the New York Agricultural Experiment Station narrates (pp. 216-223) experiments made at the station with insecticides upon some of our more injurious insect pests; and contains, also, a notice of a very interesting fungus attack upon *Phytonomus punctatus* (pp. 258-262), which is believed to have been communicated through the agency of a fertilizer employed. The fungus is named by Prof. Arthur, botanist of the station, *Entomophthora Phytonomi*.

The Fourth Report of the Ohio Agricultural Experiment Station for 1885, devotes six pages to experiments with insecticides, and the best method for their application.

An Experiment in Silk Culture, by Prof. T. J. Burrill, made under the direction of the Illinois University, is published in the proceedings of the sixth meeting of the Society for the promotion of Agricultural Science. The experiment terminated in the study of a contagious disease that broke out in the larvæ that were being reared, which was believed to be identical with the *flacherie* of the silk-worm in France, observed by Pasteur. The disease had never been previously recorded as existing in this country but is now thought to have long prevailed among our native Lepidoptera, and to have been the cause of a recent epidemic in the *Pieris rapæ* larvæ. The causes that may have led to the outbreak of disease among the silk-worms attempted to be reared, are considered in the paper.

In the same publication, is an abstract of a paper by Prof. C. V. Riley, on *Grasshopper Injury*. A periodicity in wide-spread locust injuries averaging about every eleven years is accepted. It is claimed to be possible to predict the degree of destructiveness. Thus, increasing injury for the years 1886 and 1887 may be expected should the weather favor; but even under the most favoring conditions, these injuries can never again be so wide-spread, it is asserted, as between 1874 and 1877.

Prof. S. A. Forbes, who has for some time, been paying special attention to the diseases of insects with a view of their propagation for the destruction of injurious species, has published in a Bulletin of the Illinois State Laboratory of Natural History (vol. ii., pp. 257-321) an elaborate paper entitled *Studies on the Contagious Diseases of Insects*. In it he discusses *flacherie* in the cabbage-worm, *Pieris rapæ*, describing the disease minutely, its characteristic bacteria, the evidence of its contagious nature and of the ability of conveying it by an artificial culture of the Micrococcus. In the same painstaking manner, jaundice, found associated with *flacherie* in the silk-worm, by Professor Burrill, is also discussed. *Flacherie* in *Datana Angusii* is described, with its characteristic bacteria, their artificial cultures, and contagious nature. The paper concludes with a notice of the aid rendered by *muscardine* in arresting wide-spread desolation in forests and orchards, in Southern Illinois, in 1883, caused by a remarkable prevalence of the forest tent-caterpillar, *Clisiocampa sylvatica*.

The Insects of Betula in North America, by Anna Katherina Dimmock, of Cambridge, Mass., contained in Psyche, iv, pp. 239-243, 271-286, is an admirable compilation, and may justly serve as a model for similar lists. It is not a simple record of the 107 species noticed as feeding on *Betula*, but valuable notes are given upon each insect—of development, habits, history, etc., the other plants upon which it is known to feed, with refer-

ences to authority and publication. Where bibliography is so extensive and of such importance as to justify it, an entire page, of small type, is devoted to a single species. It is to be hoped that this is but the first of a series of similar publications by the author.

A published abstract of a paper read by Mr. Amos W. Butler, before the American Association for the Advancement of Science at its last meeting, on *The Periodical Cicada in Southeastern Indiana*, gives the time and duration of its visitation, the mode of oviposition, abundance of the var. *cassini* Fisher in a distinct territory, the sounds produced, prevalence of a fungus attack, their destruction by mammals, birds, and fishes, and the comparatively slight damage resulting from the visitation. The paper affords evidence of well-trained habits of observation in the author.*

Dr. Hagen has communicated an interesting observation made by him of the destruction of living trees, of the red maple, *Acer rubrum*, by white ants, in Cambridge, Mass. (Canad. Ent., xvii, p. 134).

Mr. Frederick Clarkson has found, that under some circumstances at least, the development of the oak-pruner, *Elaphidion villosum*, is different from that ascribed to it by Drs. Harris and Fitch, in that the insect may mature within its burrow as early as in the month of November (id., ib., p. 188).

Mr. John J. Jack reports serious injury to a crop of beans, through the attack of an Anthomyian fly, *Anthomyia angustifrons*, the larva of which attacked and destroyed the plants before they reached the surface of the ground (Canad. Entom., xviii, 1886, p. 22).†

This form of Anthomyian attack, akin to that of the seed-corn maggot, *Anthomyia zeæ*, may afford a solution of the frequent eating out of the interior of melon and some other of the larger seeds beneath the ground, by hitherto unknown enemies, which has been brought to my notice.

Professor Riley has made an interesting communication to Science (vol. vii, p. 394), to the effect that *Feniseca Tarquinius*, one of our rarer butterflies, has been found to be carnivorous in its larval stage—the only known instance of a carnivorous butterfly, and that its food consists of plant-lice, especially of the gall-making and leaf-curling species of *Pemphiginæ*.

This publication solved what had been a mystery to me. A piece of a branch of some tree, apparently an alder, was sent to me in October last, thickly covered with the flocculent bodies of some woolly aphis, probably a *Schizoneura*. It was left in the box in which received, awaiting further notice. Upon casually opening the box early in April, to my great surprise, a newly emerged and perfect *Feniseca Tarquinius* was found therein; also, the short, stout chrysalis case from which it had escaped, and an undeveloped chrysalis, each suspended by its cremaster from the sides of the box. How and where the larva conceals itself during its growth is an interesting inquiry.

A communication made to Science (May 28, 1886, vii, pp. 481-483), by R. I. Jackson, records a New Museum Pest, in *Lepisma domestica*. It had been discovered as very injurious to labels; and it is further believed to be the author of the injury often reported, to muslin curtains, silks, etc., commonly charged upon the carpet-beetle, *Anthrenus scrophulariæ*, as similar injuries are known to have resulted from species of Lepisma in other countries, as well as to books, maps, papers, etc.

Entomology in Agricultural Journals.

Our leading Agricultural Journals are the media of no inconsiderable amount of information of the means for controlling insect depredations. They furnish convenient channels through which inquiry may be made from any portion of the Union of any unrecognized form of attack, and an intelligent reply elicited.

Professors Riley and Cook are frequent contributors to the columns of the *Rural New Yorker*.

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* The paper has been published in full, during the present month, in Bull. No. 12, of the U. S. Dept. of Agriculture, — Division of Entomology, pp. 24 to 31.

† This occurrence is subsequently noticed at greater length in Bull. No. 12, of the Division of Entomology, p. 32-33.

The *Prairie Farmer* maintains an Entomological Department, averaging two columns weekly in extent, under the editorship of Clarence M. Weed.

The same department, in the *Fruit Growers' Journal*, of Cobden, Illinois, containing weekly contributions, is edited by Professor G. H. French.

To the *American Agriculturist*, occasional contributions are made and inquiries answered by Professor Riley.

The *Spirit of the Farm*, of Nashville, Tenn., is publishing a series of entomological articles, by the entomological editor, Prof. E. W. Doran.

The *Pacific Rural Press* keeps its readers well-informed of the active entomological work being prosecuted in California, in the struggle for the preservation of the fruits of the State from the onslaught of, thus far, an invincible army of scale-insects.

The *New England Homestead*, of Springfield, Mass., encourages the observation of insect habits and injury, in the publication of much valuable information in this direction.

The *Country Gentleman*, of Albany, N. Y., receives many inquiries of insect attacks, which are answered, often at considerable length, by the State Entomologist of New York.

INTERESTING ENTOMOLOGICAL STUDIES, ABROAD.

In addition to the preceding notice of the publications of our entomologists, may I be permitted to refer to some studies of particular interest which have been given us during the year, outside of our country, to which general attention may not have been drawn.

Recent studies of Forel, Kraepelin, Hauser, and others, had placed almost beyond question, the location of the sense of smell in insects, in the antennæ. Later, the study has again been taken up by Prof. V. Graber, of the University of Czernowitz, Austria, with results that serve to reopen the question, and invite to further investigation.

In a late number of the Comptes-Rendus of the Société Entomologique de Belgique, his conclusions are summed up as follows:

1. The perception of odors is not confined to the antennæ, for ants and *Lucilia Cæsar*, deprived of their antennæ, retained the perception.

2. The antennæ are perhaps more sensitive to odors than other parts of the body. *Silpha thoracica* deprived of its antennæ, was affected by some odors but not by other weaker ones.

3. The palpi may be more sensitive to odors than the antennæ, as would appear from some experiments made with *Gryllotalpa vulgaris*.

4. In a large series of experiments with a *Lucanus* which followed the odorous material employed, sometimes the palpi and sometimes the antennæ, were the more rapidly excited.

5. The perception of odors may also lie in the anal stylets, as shown in a decapitated *Periplanata*. (This idea had been previously advanced by Dr. Packard, Amer. Nat., iv, 1870, p. 620.)

6. Insects have no special organ of smell.

The studies of Exner, communicated to the Vienna Academy in 1875, led to the rejection of the mosaic theory of vision in insects as necessarily attendant upon their compound eyes, and to its replacement by the theoretical deduction that they do not distinguish the form of objects, but that their vision consists mainly in the perception of movements and of colors. Their faceted eyes are not complete visual organs, but simple organs of orientation.

In a subsequent communication by Plateau, to the Royal Academy of Belgium, he has presented the following conclusions drawn from studies of Diptera, Hymenoptera, Lepidoptera, Odonata, and Coleoptera.

In diurnal insects with compound eyes, the simple eyes offer so little utility that it is right to consider them as rudimentary organs.

Insects with compound eyes do not notice differences of form existing between two light-orifices, and are deceived by an excess of luminous intensity as well as by the apparent excess of surface. In short, they do not distinguish the form of objects, or if they do, they distinguish them very badly (American Naturalist, xx, p. 69).

The structure of the halteres of Diptera has been studied by Mr. A. B. Lee, who finds them to embrace two distinct organs, one an auditory organ, and the other of problematical function, which may be olfactory (Entomologische Nachrichten, for August. 1885).

Sir John Lubbock records as an instance of remarkable longevity in ants, that two queens of *Formica fusca* had been kept alive by him within their nests for twelve years (Contemporary Review, for November, 1885).

The Insect Fauna of the United States.

Returning to our country, unmistakable evidence of rapid progress in our science is to be found in the explorations by private individuals, institutions, and government surveys, of almost every portion of our country for unknown species and the prompt study of the material obtained, by competent specialists.

Our lists of species are rapidly augmenting.

In a paper recently read by me, not yet published, on the *Present State of Entomological Science in the United States*,[*] I had occasion to state the number (as near as could be conveniently ascertained) of the described species of North American insects, North of Mexico. As the paper contained some estimates specially made for it, it may be of interest to present the table at the present time.

Hymenoptera (Cresson's estimate):		
Phytophaga	573	
Entomophaga	2,166	
Prædores	1,078	
Anthophila	633	
		4,450
Lepidoptera: Butterflies (Edwards List, 1884)		614
Moths (Grote Check-List, 1882)		3,184
Tineidæ, not included by Grote, (Chambers List, 1878)		779
Diptera (Osten Sacken estimate, in 1878)		2,500
Coleoptera (Henshaw List, 1885)		9,507
Hemiptera-Homoptera (Uhler estimate, 1886)		1,200
Heteroptera (Uhler Check-List, 1886)		1,448
Orthoptera (Scudder estimate, 1886)		450
Neuroptera, not estimated—perhaps		1,000
Giving a total of		25,132

Limited Knowledge of the Early Stages of Insects.

Upon former occasions when it has been my privilege to address this Club officially, I have urged the importance of the study of the earlier stages of our insects upon its members and upon all students in entomology. I beg leave to repeat the recommendation, in view of the value of such study in a scientific classification, and the necessity of it in economic investigation, for of but comparatively a small number of our insects are the earlier stages known, and of only a few do we possess full life-histories.

Although the Coleoptera have been the most thoroughly worked of any of the orders, yet it will surprise some of you to learn, as it did me, when I recently received the information from an eminent Coleopterist, of how small a proportion are the earlier stages known.

By permission of the writer, Mr. E. A. Schwarz, I give the communication addressed to me in reply to an inquiry made, in which the information above referred to is embodied. It is of so much interest and value, that it deserves publication:

"I have endeavored to keep track of the descriptions of Coleopterous larvæ from all countries. I herewith select at random a few of the larger families, and do not believe that the proportion of the known larvæ to the total number of species would be materially changed if I would go through all families. For the *Chrysomelidæ*, unfortunately, I can not get at the figures without much trouble.

[* Since published; see pages 283-292 of this Report.]

"In *Carabidæ*, including the *Cicindelidæ*, there are described, in round numbers, the larvæ of 120 species representing forty genera, out of a total of 9,300 species.

"In *Dytiscidæ*, there are described 22 species representing 13 genera, out of a total of 950 species and 35 genera.

"In *Hydrophilidæ*, there are described 30 species representing 14 genera, out of a total of 570 species and 30 genera.

"In *Staphylinidæ* are described 75 species with 37 genera, out of a total of 4,130 species and 270 genera.

"In *Silphidæ* are described 25 species with 9 genera, out of 460 species.

"In *Scarabæidæ* are described 85 species in 40 genera, out of 6,550 species.

"In *Buprestidæ* are described 70 species in 20 genera, out of about 2,700 species.

"In *Elateridæ*, about 60 larvæ described out of a total of 3,100 species.

"In *Curculionidæ*, about 260 larvæ described in 65 genera, out of a total of 10,150 species.

"In *Cerambycidæ*, about 150 species of larvæ described in about 70 genera, out of a total of 7,600 species.

"A summing up of the above shows that there are about 900 species of larvæ described out of a total of 45,600 species, giving a proportion of 1 to 50. Since the publication of the Munich Catalogue, the description of new species has gone on with unabated activity, while, at the same time comparatively very few larvæ have been made known. Thus the proportion will be now somewhat below *two per cent.* This refers to the whole world. For the European fauna alone, the proportion is of course considerably higher, while for the North American fauna, the proportion is but little above the average, and hardly reaches 1 to 40, even including all of the unpublished larvæ which are in our collections. Of the 83 families of the North American Coleoptera, the larvæ of no less than 20 families are entirely unknown."

THE BUREAU OF ENTOMOLOGY AT WASHINGTON.

In consideration of the contributions made toward the advancement of entomological science through the investigations and publications of the Division of Entomology of the U. S. Department of Agriculture, it must be a source of gratification to us all, that at no time since the establishment of the bureau, has it been in position to render more efficient service than at the present. The recognition of its value and importance has drawn to it the aid and the support that it needs for its successful operations. It is much to be regretted that just at this time, its activity should be somewhat impaired, by the ill health of its Chief Officer, compelling a temporary respite from official duties. I know that you will unite with me in the earnest desire that the restoration of health which he is seeking in rest abroad, may be speedy and complete.

Valuable aid to economic entomology may be confidently expected from the "Division of Economic Ornithology and Mammalogy," recently established in Washington, under charge of Dr. C. Hart Merriam, in the investigations that are being conducted by it in the food-habits of our insectivorous birds.

INSECTS OF THE NATIONAL MUSEUM, ETC.

The appointment of one of the active members and an officer of our own club, to the assistant curatorship of the Department of Entomology of the National Museum, under provisions that will permit of the proper care and increase of the collections, is a gratifying event of the past year. This Department now contains the Riley collection recently donated to it of 15,000 species and 115,000 specimens; the collection of the Department of Agriculture of 50,000 specimens, and probably 5,000 species not in the Riley collection; the collection of the National Museum proper, estimated at 20,000 specimens, and 2,000 species not in the other collections; and the New Orleans Exposition exhibited collection of economic entomology, of which a catalogue has been printed and distributed. The aggregate may be given as 200,000 mounted specimens, and 26,000 distinct species. (*Science*, November 20, 1885, vi, p. 445.)

The admirably prepared collection of Lepidoptera of Mr. Otto Meske, of Albany, N. Y., embracing a fine exhibit of the New York fauna, rare material from Texas and other

Western States, together with an excellent representation of the European fauna, received through the exchanges conducted for many years with Dr. A. Speyer, of Austria, has recently been purchased by the National Museum, and is now in its possession.

The collection of Insects of the Peabody Academy of Science, at Salem, has been deposited in the Museum of Comparative Zoölogy at Cambridge. It had mainly been brought together by Dr. A. S. Packard, and contained a large proportion of his types, including all those (except four belonging to other entomologists) of his Monograph of Geometrid Moths. It also contained types of other eminent entomologists.

I feel that an apology is due for the length of my paper. Its excuse must be found in the activity that has characterized entomological study for the past year. Even in the time that I have occupied, I have only been able to refer to some of the work done, while omitting much that is equally — perhaps more — worthy of notice.

[From the Report of the American Pomological Society, for 1887.]

SOME PESTS OF THE POMOLOGIST.

(Read before the American Pomological Society, at its Boston meeting, September 15, 1887.)

The large attendance at this convention, the several States of the Union represented, the distinguished men participating in it, the high order of the discussions and papers that have been presented, the exhibit of fruit that is made — all bear testimony to the widespread interest of the present day in fruit-culture and the great advance that has been attained therein.

Progress in Pomology.

It is not my province to do more than mention the progress made in fruit-culture within a few years past. This privilege belongs to those who have been active participants and agents in its stimulation and remarkable growth. We can not but recognize its results in the many fruits it has given us previously unknown in our markets — varieties far surpassing those which we formerly enjoyed, and an abundance such as we had never dreamed of, brought within reach of all.

Evils Attending Progress in Pomology.

Yet this has not been attained without attendant evils. Here, as elsewhere, in all that pertains to the advancement of our race — at every step of progress, a penalty has been incurred and exacted. It is patent to all that the development of Pomology into a science and an important industry of our country, has only been accomplished through a great increase of plant diseases and a remarkable multiplication of insect pests. These two evils follow as a necessary consequence of the advance made: They are connected therewith as inseparably as cause and effect. And what part they are to play in the future in retarding, arresting or ruining fruit-culture, must depend upon the manner in which they are met by the enlightened fruit-grower.

Need of Scientific Study.

You do well, gentlemen, in calling to your aid whatever science is able to do for you in the investigation of the serious evils to which I have referred. It is of the utmost importance that you should know each one of your enemies, whether it be a soil constituent, a vegetable, or an animal — its character or nature, whence it proceeds, how it acts, and above all, the most economical and efficient means for overcoming it. You particularly need the best skill of the chemist, of the botanist, the mycologist, and the entomologist. Their services are freely at your command, whether asked for of our Scientific Schools, Agricultural Colleges, State Experiment Stations, the United States Department of Agriculture at Washington, or of our State Entomologists.

Demands of Science on the Pomologist.

But let me remind you that you too have an important part to perform in this needed observation, study and investigation of plant diseases and insect injuries. You are

brought face to face with them, day after day, more intimately, more continuously, and I may add, more advantageously than is possible for the scientist to be. Your trained eyes are quick to detect the first indication of disease or injury; and you should be able to discern its nature, to the extent, at least, that you may promptly summon to your aid, if aid be needed, that particular scientific investigation which the occasion demands. And what a broad field of coöperation with the specialist is open, if, when through the aid extended, you have been led in the proper direction, you not only faithfully follow the course marked out for your guidance, but also test the value of experiments that will naturally be suggested by the failure or partial success that meets your efforts.

The sciences that are lending you their cordial coöperation have a claim upon you—yes, have a right to demand this at your hands. Upon you is chargeable the curse that surely is hanging over, if not already fallen upon, fruit-culture in our country—"in the sweat of thy face shalt thou eat" fruit! I do not overstate when I say, that the great increase of plant diseases and insect ravages that you are experiencing is the direct result of the enormously increased production of fruit, and the large area in which fruit crops are massed.

IMMENSE FRUIT PRODUCTION—NO OVER PRODUCTION.

Compare the production of fruit to-day with what it was in the childhood of any here present, both in variety and quantity. To go back farther than many of you are able—in my childhood, an orange was a rarity; a peach was seen at intervals of years. I only knew one variety of cherry; our apples did not exceed a score, and pears a half score. Now, freight trains of fruits of almost countless varieties are rolling over our country, carrying the delicious and healthful products to central marts, whence they may be distributed to every home in our land, and even find their way beyond the oceans that bound our continent. No wonder, it may be remarked in passing, that under such production, prices may, at times, become very low, and the cry is heard, "raising fruit does not pay!" A prominent member of one of our horticultural societies recently made this remark in a public address: "There is such an over-production of these fruits (referring to a certain class) that they will no longer pay, unless some insect pests will come and relieve us of half the crop." What a ridiculous, pitiable, senseless statement to make! Markets that will yield remunerative prices are, and will continue, to be found to enterprising, energetic, sagacious business men. If not already existing, they may be built up, and the demand will surely follow. There can be no over-production, for the retarding houses, canneries and evaporators, springing up in all our fruit regions, will keep pace with production. The desire for, the need of, wholesome fruit will ever be in excess of its growth. As its price falls—to quote the words of a fruit dealer in Philadelphia, who last September received and sold in three days 665,000 pounds of grapes—"everybody wants it." Should an unusually favorable season give a yield beyond the possibility of gathering, transportation, or preservation, why not try the experiment of giving the freedom of your orchards to "the poor whom ye have always with you," and see if it is not almost as good to give as to receive.

It does not appear to be known what the aggregate value of the fruit crop in the United States amounts to, but surely that must be a safe estimate that places it at between two hundred and three hundred millions of dollars annually.

LARGE AREAS DEVOTED TO FRUIT CROPS.

This enormous production which is but the natural outgrowth of the discovery of the peculiar adaptation of the soil and climate of many portions of our country to fruit-culture, has compelled its cultivation in larger areas than anywhere else in the world. An apple orchard on the Hudson river, at Greenport, N. Y., covers 300 acres. At Orchard Hill, in Georgia, is a peach orchard of 790 acres, and 84,000 bearing trees. The vineyard of Leland Stanford, at Vina, California, has 4,000 acres in vines in a tract of six miles long by two wide.

How does this massing of crops tend to promote an increase of insect ravages? Let me illustrate it by what I have elsewhere written of our apple insects:

"Two hundred years ago not even the wild crab, the earliest representative of the *apple* existed in this country, and consequently there were no apple insects. Later,

when a few apple trees became the adjunct of the simple homes of the early settlers, those of our insects to which they offered more desirable food than that on which they had previously subsisted, were obliged to wing their way often for many miles in search of a tree upon which to deposit their eggs. If birds were then abundant, how few of the insects could safely accomplish such extended flights. But in the apple orchards of the present day—some of them spreading in an almost unbroken mass of foliage over hundreds of acres—our numerous apple insects may find the thrifty root, the vigorous trunk, the succulent twig, the tender bud, the juicy leaf, the fragrant blossom, and the crisp or mellow fruit spread out before them in broad array, as if it were a special offering to insect voracity, or a banquet purposely extending an irresistible invitation to the tent-caterpillar, the codling-moth, the canker-worm, the striped-borer, the bark-beetle, the twig-borer, the leaf-aphis, the bark-louse, the root-louse, and every other of our two hundred species of apple insects. Here they may luxuriate as nowhere else. The required food is greatly in excess of insect need. Careful cultivation has made it the best of its kind; appetite is stimulated; development is hastened; broods are increased in number; individuals are multiplied beyond the conservation of parasitic destruction; facilities of distribution are afforded with hardly a proper exercise of locomotive organs, and when these almost useless members have become aborted, as in the wingless females of the bark-louse (*Mytilaspis pomicorticis*) and the canker-worms (*Anisopteryx vernata* and *A. pometaria*), the interlocking branches afford convenient passage from tree to tree."

INCREASE IN PLANT DISEASES.

The same causes, viz., high culture, enormous production, and massing in large areas, inevitably promote plant diseases. Let me, in passing, simply name a few of these, since they are so intimately connected with insect attack, being often its precursor or its sequence—and then leave them to be discussed by those to whom their study properly belongs.

Of the more than two hundred species of fungi known to infest the grapevine, special attention has been called within the last few years, to the following, from the serious losses that they have occasioned: The Downy mildew (*Peronospora viticola*); the Powdery mildew (*Uncinula spiralis*); the black-rot (*Physalospora Bidwellii*); Anthracnose (*Sphaceloma ampelinum*), a comparatively new grape disease in this country, but one long known in Europe, which attacks the vine, the leaf and the fruit.

Of other well-known and destructive diseases, are the peach yellows (no satisfactory cause or cure for which has yet been discovered); the peach-leaf curl (*Exoascus deformans*); the plum-rot (*Monilia fructigena*); the black-knot (*Plowrightia morbosa*) of the plum and cherry; the plum-leaf fungus (*Septoria cerasina*), affecting also the cherry and the apricot, and peach slightly, causing often one-half of the leaf to die and fall away in rounded holes, as in examples recently received by me from an orchard in Canada; the apple rust (*Rœstelia penicillata*); the apple and pear scab (*Fusicladium dendriticum* and *F. pyrinum*); the pear-blight, so extensively written of and but lately shown to be caused by the bacteria which has been named *Micrococcus amylovorus*, also infesting the apple and several other fruits; the tomato-rot in green fruit (probably *Cladosporium fulvum*); the gooseberry blight; the raspberry rust (*Cœoma nitens*); and the spot disease or leaf-blight of the strawberry (*Ramularia Tulasnei*). The causes and cures of these and of many others associated with them, are deserving, from their great economic importance, of all the study that is being given to them. Valuable results are expected from the establishment about a year ago of a mycological section in the Department of Agriculture at Washington, specially charged with the study of the fungus diseases of plants; and it was very fitting that this section should have received the cordial indorsement of your society so promptly given it.

New diseases are being discovered from time to time. A very remarkable one has lately been reported to the State Horticultural Society of California. The writer names it, "**Paralysis** of Apricot Trees." It had been observed by him in three different cases

in three years, in apricot and apple trees that had been grafted on other stock. They were of exuberant growth, in healthy foliage and were bearing, abundantly, normally developed fruit. It is described as follows:

"In the morning the trees appeared to be in full health; shortly after 10 o'clock the leaves suddenly became weak and every leaf, without exception, hung lifeless on the tree. In the afternoon the fruit and bark began to shrink, and in forty-eight hours all the leaves and young shoots were entirely withered and the fruit shrunken and nearly dried up. Two trees were tested with the knife, and it was found that the paralysis and death had taken place from the grafting-point upward."

INCREASE OF INSECT RAVAGES.

Passing now to insect pests — it is surely evident to every fruit grower that, with each successive year, the difficulty of growing choice and perfect fruit is becoming greater. He can no longer ignore the insect as an insignificant object in nature, almost unworthy of regard. The myriad hosts confront him on every side and demand his attention. They claim the choicest products of his labor — not a tithe of them, which might, perhaps, be granted, but the entirety. It is a struggle for mastery, in which he must conquer the insect, or the insect will conquer him.

The primary causes that have necessitated this warfare have been given you in general terms, but the consequences of these might not extend much beyond a multiplication of the individuals of a species. But beyond this, another serious element is forced upon us, viz., a continual increase in the number of species preying upon fruits.

FOOD-HABITS OF INSECTS.

You all know that our noxious insects are divisible into many groups, indicated by the food-plants upon which they subsist. Thus we have our grass insects, our grain insects, insects infesting our forest trees, those infesting our flowering plants, those attacking garden vegetables, a long list of household pests, those that live upon our domestic animals, etc., etc. Insects are more or less particular in their food. There are those that confine themselves to a certain species of plant and will starve rather than change to another. Very many will feed upon allied plants as associated by structure and character in a genus or a family; while others, polyphagous species, as they are termed, extend their range through different and often dissimilar orders of the vegetable world.

CHANGE OF FOOD-PLANTS.

Thus it is that the fruit grower not unfrequently has to contend with some insect depredator quite new to him and to his locality. He submits it, as he should, to some authority in entomology, and it is found to be a species previously known as subsisting on some other food-plant. Chance, it may be, has brought it to an apple tree, and it at once finds in its material, food more agreeable and attractive to it than that on which it had hitherto fed. It becomes an apple tree insect, and displays under the stimulating effect of its changed diet, far more destructive habits than those that before pertained to it. To illustrate: A little bark-boring beetle (*Scolytus rugulosus*), which for several years had been known to us only as destroying cherry, peach, and plum trees, has been discovered by me the present year as working in large numbers beneath the bark of apple trees and quickly killing them by running its galleries over and around the trunk until it is completely girdled.

INTRODUCTION FROM ABROAD.

Again, the new pest proves to be an introduced species, brought over from Europe through some commercial avenue, readily planting itself in its new home, and spreading from thence over the country as broadly as the area of its food-plant or suitable climatal conditions will permit. And almost without exception, a species thus introduced from abroad, unattended by its natural parasites and freed from other enemies that had learned to prey upon and control it, is at once transformed into a pest of such magnitude, that its harmlessness in the old world is in marked contrast with its ravages in the new.

SPREAD OF SCALE INSECTS.

In illustration of the evils often attendant upon a change of food-plants and extention of range, and also the increased destructiveness of introduced species, we may refer to the struggle which the fruit growers of California are at the present time undergoing with insect pests, and notably with scale-insects, which have followed the recent extended culture of the citrus fruits, particularly the orange, in that State.

Attack by the members of this family, known as the *Coccidæ*, is always dreaded, as they multiply with amazing rapidity, and are protected during nearly all of their life by a shield-like covering which is impervious to such applications as ordinarily suffice to destroy more exposed forms. They are not even amenable to the poison of arsenical preparations, which are our best insecticides wherever they may be safely employed, as they find their food in the juices of plants, extracted by means of a needle-like proboscis driven through the bark, or epidermis of the leaf.

The scale-insect, which is especially enlisting widespread attention in California, receiving the most careful study, and, from the difficulty of its control, exciting great alarm, is known as "the fluted scale," or "the cottony-cushion scale," from the peculiar and conspicuous cotton-like mass attached to it and sheltering its eggs. Scientifically it is known as *Icerya Purchasi* Maskell. Australia, South Africa, New Zealand and California are its only localities, so far as known to us. Its original food-plant is believed to have been an Acacia—thorny trees or shrubs belonging to the *Leguminosæ*, of which we have no native species north of Texas. On an Acacia imported from Australia it was in all probability introduced into California in 1868 or 1869. From this plant it spread to various orchard and ornamental trees, garden plants, weeds, etc. A few of these may be enumerated as showing the possible range of some of these pernicious scales: Orange, lemon, quince, pomegranate, apple, pear, peach, apricot, fig, strawberry, grape, hawthorn, walnut, oak, pine, cypress, laurel, locust, elm, willow, ivy, rose, verbena, and box. According to a writer in New Zealand, "it attacks all sorts of plants." It is proving particularly destructive to the orange, entire plantations of which have been completely destroyed. Not yet overspreading the entire State, the most earnest efforts are being made to arrest its distribution. Laws have been enacted, under which fruit inspectors have been appointed, whose duty it is to enforce the laws, and even to search out the infested trees and compel their destruction.

The interest taken in this crusade against insect pests in California, and the desire to conduct it in the most efficient manner, is shown in the following extract from an address recently made by the Secretary of the California Horticultural Society:

"Every effort is being made by horticulturists to resist the spread of fruit-pests. Every method suggested by reliable scientists and fruitmen is being thoroughly tested. Usually not much urging is required to induce the owners of pest-ridden orchards to try the latest discoveries, as they are only too willing to attempt the eradication of their insect enemies. In this way many new applications are being discovered. If we can succeed in checking the ravages of the pests, this State is bound to become the orchard of the world." (*Pacific Rural Press*, August 20, 1887, p. 145.)

FIG. 68.—The cottony cushion-scale, ICERYA PURCHASI, on orange.

It is devoutly to be hoped that the "Australian bug," as it is sometimes called, together with the Red Scale (*Aspidiotus aurantii*) also introduced from Australia, and others of its associates, may not become distributed over the United States, to add to the already almost overwhelming number of our fruit insects.

There is little danger of the introduction this side of the Rocky mountains of the larger number of the California scale-insects, through the fruit which is being brought eastward, for nearly all of them are fixed to the plant upon which they subsist during their entire life except a brief period following their hatching from the egg. The Icerya, or Fluted Scale, unfortunately possesses habits more favorable to its spread, for it remains free and travels about during the greater part of its existence. In its last stage — according to Professor Riley, to whom we are indebted for the elaborate study of this insect as given in his last annual report,* — and just before the production of its eggs, it shows a disposition to travel in search of some place of concealment, as beneath rough bark. Under this impulse, it might leave the tree and find a convenient hiding-place in some fruit package, and there be conveyed by rail to a distant locality. The common mode of distribution of scale-insects is through the sale of scions and nursery stock. I do not know if these are being brought from California eastward. If such a business has been inaugurated (of which there would seem to be no need), every effort should be made to suppress it, as it would not be possible to institute such a system of inspection for the detection and destruction of infested stock, as has been adopted by several of the countries of Europe to protect them from the introduction of the terrible Phylloxera pest.

I have dwelt at some length on these scale-insects, in consideration of their extreme virulence and the harm that will attend their spread. When they have been allowed to gain the footing that they now have in California, it is not possible to exterminate them. The most that can then be accomplished is to reduce their numbers, and to exclude them from localities now free from their presence. I believe that the Icerya has not yet shown itself in the orange groves of Florida. Whenever it shall do so, unless it be met as promptly as we are accustomed to deal with a rabid animal, it is safe to predict that the orange culture of that State is doomed. Arizona is just giving promise of becoming a wonderful fruit region. As yet, it is almost free from fruit pests. Peaches, it is claimed, can there be eaten from the tree from June to December. If so, with proper railroad facilities, we in our Eastern cities could enjoy the delicious fruit during one-half of the year. How desirable it is that such prospects should not be blighted by permitting an influx into Arizona of the scale and other pests which it is possible to exclude, for years, at least.

NUMBER OF INSECT PESTS.

I have referred to the large number of our fruit-pests, in species, of perhaps equal importance with the number of individuals, since each one of the species requires separate study that its particular life-history and habits may be learned, and thereby a knowledge obtained of the best method of dealing with it. If a noxious form, then the most efficient means for its destruction is to be sought; if beneficial, in the great service that it renders in preying upon injurious species, as are entire families, as those of the Ichneumons, Lady-birds, and others — in that case study must be made of how it may best be protected, and its multiplication promoted.

Of the 325,000 species of insects known to science through name and description, as existing in the world, 25,000 belong to the United States. Of these 15,000, at least, would be regarded as injurious, from preying upon material serviceable to man. The amount of harm inflicted by many of these is inconsiderable; and probably not exceeding one-half of the number, or from 7,000 to 8,000 may justly be regarded as insect pests.

The number of fruit insects can not be definitely stated. Four years ago I published a list of 176 species of insects depredating on the apple. Since then I have enlarged the

* *Report of the Commissioner of Agriculture* for 1886, pp. 465-492, plates i-v. See, also: Icerya or Fluted Scale *Bulletin* 15, *U. S. Dept. Agricul., Division of Entomology*, 1887, pp. 40.

list one-fifth, making it to contain at present, 210 species. Doubtless a thorough examination of published and manuscript records of food-plants, and direct observations in the orchard, would extend the number to nearly if not quite 300. With this as a basis, we may safely conclude that the number of fruit insects in the United States is at least 1,000.

And every year is adding to the number. Several new ones have come under my observation the present year.

AN UNKNOWN CURRANT INSECT.

To one of these new fruit pests, of more than ordinary interest to me, I will ask your attention, in the hope that if its operations are widespread, the unknown insect inflicting the injury may be discovered while engaged in its oviposition, by some one of you, as otherwise its identification may elude us for years.

During the latter part of May and early in June the tips of the new and more vigorous shoots of both the black and the red currant were observed, in gardens at Albany and vicinity, to be girdled, drop over, wither and finally to break off and fall to the ground. The girdling is done by five or six sharp, deep and rather long incisions in the same plane, nearly surrounding and severing the stalk, and seeming as if made by strong mandibles. It is entirely different from the two circles of punctures made by the well-known raspberry-cane girdler, *Oberea bimaculata* Oliv., and moreover, the oviposition is within the tip that falls to the ground—not in the standing cane. It would, therefore, be difficult to rear the insect from the egg, deprived, as it would be, in confinement, of its natural conditions. The girdling is probably done during the night.

HOW INSECT RAVAGES ARE TO BE MET.

And now, to proceed to the more practical part of my paper: What must the nurseryman and the fruit grower do, that they may effectually meet these annually increasing insect ravages. The plant diseases of rust, smut, blight, mildew, etc., to which I have referred, belong to, and are left for, others to discuss.

I need not urge upon the members of this Society the importance of their recognition of the amount of harm to which they are exposed from insect injury. Individual experience has taught the absolute necessity of such recognition. Certain it is that he who will hereafter achieve the best success in the growth of fruit or fruit trees, will be he who has best informed himself of insects and how to deal with them. In the hands of such, the business will continue to be profitable, while the thriftless, careless, and ignorant will have to seek other occupation, more congenial to his quiet tastes and easy-going nature.

While the fruit grower has not the opportunity for becoming a technical entomologist, he may at least acquire such a general knowledge of the elements and applications of economic entomology as are taught and explained in scores of publications issued gratuitously during the last few years by several of the States and the General Government, for the sole and only purpose of diffusing, broadcast, knowledge so important to individual and national prosperity.

May I venture to offer what seems to me, from my stand-point, some reasonable requisites of the successful fruit grower of the future?

1. He should be acquainted with all of the more common insects that occur, or are liable to occur in his vicinity—their names (not necessarily their scientific ones), the nature of their injuries (if injurious), their more important habits, and be able to identify them in their different stages.

2. He should be so familiar with his ordinary visitants that he would detect the advent of an unusual or new form, so that it could be promptly submitted for such study as it might need.

3. He should be able to distinguish between his insect friends and foes, that he might not unwittingly destroy the former, or employ such remedies against the latter as to involve both classes in a common destruction, accomplishing thereby more harm than good.

4. He should be able to refer them to the Orders to which they belong in classification, that he might speak or write of them understandingly and properly — not grouping all under the name of "bugs." The commonly accepted Orders are but seven and may be easily learned. They are these:

1. Hymenoptera — Bees, wasps, hornets, ants, saw-flies, etc.
2. Lepidoptera — Butterflies and moths.
3. Diptera — Flies, mosquitoes, gnats, etc.
4. Coleoptera — Beetles.
5. Hemiptera — Plant-lice, scale-insects, tree-hoppers, etc.
6. Orthoptera — Crickets, grasshoppers, etc.
7. Neuroptera — Dragon-flies, May-flies, caddis-worms, etc.

5. He should know the manner of insect feeding, so as to be able to employ the proper class of insecticides.

6. He should be informed of the method of preparation and of application of the best insecticides.

7. He should experiment with such remedies and preventives as his own observation and experience may suggest.

8. He should avail himself of the publications in economic entomology relating to fruit pests. These have become numerous and can not fail of proving of great service.

The first three of what I have named as requisites of the successful fruit grower, viz.: Names of insects, recognition of new forms and discrimination between foes and friends — may be largely met by the use, in connection with observation of the living insects, of the volume entitled, "Insects Injurious to Fruits," by William Saunders. It is an exceedingly valuable compilation of most that is desirable to be known, for practical uses, of our fruit insects, and has been prepared by a gentleman, whose long experience as a fruit culturist, together with a high reputation as an entomologist, had in every way fitted him for the work which has been so successfully accomplished. The volume — an octavo of over 400 pages, with illustrations on almost every page — is published by the well-known publishing house of J. B. Lippincott, Philadelphia, of whom it may be ordered.

For the fourth requisite — for some knowledge of the orders in which insects are grouped, and in addition, a comprehensive idea of the families in which the orders are divided, I would recommend the purchase of Dr. Packard's "Guide to the Study of Insects." It is a large octavo of over 700 pages, abounding in illustrations, and is well adapted to the wants of those who desire some accurate and general knowledge of the insect world. The eighth edition was published in 1883, by H. Holt & Co., 29 W. Twenty-third street, New York city; price, five dollars.

For the fifth requisite — a knowledge of the manner of feeding, it is necessary, in the employment of remedies, to be able to distinguish between biting insects, the Mandibulata, which are provided with mandibles or jaws, and sucking insects, and the Suctoria, furnished with a proboscis for extracting the sap of plants. The former are killed by the application of poisonous substances to the surface of the leaves or other parts of the plants on which they feed, while the latter, living only on the interior juices, are entirely unaffected by such applications. Of this last class, are all of the plant-lice, or Aphides, the scale-insects, bugs proper, and, in short, all comprising the extensive order of Hemiptera. Against these the strongest arsenical preparations are of no avail, but they are vulnerable to applications that will affect them through their breathing pores, as, for example, kerosene, which closes these pores and produces suffocation.

INSECTICIDES.

The sixth requisite named, is a knowledge of insecticides, and of the means for applying them.

Not many years ago the only known methods of combating insect pests were hand-picking, beating from shrubs or jarring from trees on sheets spread underneath, attracting to lights or fires, and taking up and burning the infested plants. As insects

multiplied and more ample means for their control were required, insecticides, so-called, were discovered. Twenty years ago, when a beetle, whose home was in the Rocky mountains, had, at the approach of civilization, abandoned its wild Solanum food-plant for the more nutritious cultivated one, and was rolling eastward over the Western States as steadily and irresistibly as a tidal wave, the timely discovery by a citizen of Illinois that Paris green was an effectual remedy for it, at once brought under control the ravages of the devouring pest, and made the continued cultivation of the potato a possibility. Ten years thereafter, London purple, a residuum in the manufacture of analine dyes, was found to be almost equally efficacious against the Colorado beetle, and, as the fruit of experiments since conducted, we have now in these two arsenical compounds, insecticides effective against nearly all of the mandibulate insects which feed exposed on such vegetable substances as we or our domestic animals do not require for food.

The need of reaching the large order of suctorial insects which are not affected by the arsenites, led to the discovery of kerosene as a destroyer of insect life. It was found to be fatal to every insect to which it could be applied. As in its undiluted state it is also fatal to vegetation, means were sought, and were speedily found, for reducing it to any desired degree. Often as the methods of preparation of what are known as "kerosene emulsions" have been published in our agricultural and horticultural journals, it may be of service to you to give the most approved method, in a single short sentence:

The best emulsion for general use is produced by violently agitating through the rose of a force-pump until emulsified in a homogeneous mass, two gallons of kerosene to one gallon of a hot soap solution, made by dissolving a half-pound of common soap in a gallon of water.

The ordinary dilution of the above emulsion for use, is with nine gallons of cold water.

Of the various other insecticides with which the fruit grower will find it to his advantage to be familiar, as hellebore, pyrethrum, carbolic acid, coal-tar, tobacco, etc., I will not speak, but will refer you to publications in which they are fully discussed, and which constitute a part of that literature of economic entomology which should find place in the library of each one of you.

Publications Relating to Fruit Insects.

The advance made in our knowledge of dealing with insect pests, is largely due to the investigations and discoveries of the Entomological Division of the Department of Agriculture, at Washington, of which Professor Riley is chief. The publications of this division present full reports of experiments in testing almost every material that has from time to time been recommended as an insecticide, even to ice water and buckwheat flour; descriptions of various devices, implements, and machines for applying insecticides; descriptions, figures, and life-histories of our most formidable pests, with the best remedies or preventives against them, and much other valuable matter on entomological subjects.

Of these publications—of primary value are the *Annual Reports of the Entomologist* (by Professors Riley and Comstock), of the series commencing with the establishment of the Division in 1878. In addition to a limited number of these reports issued as separates, they are included in the *Annual Report of the Commissioner of Agriculture;* and as the immense edition of four hundred thousand copies of this report is printed by Congress each year, certainly every one desirous of obtaining a copy should have no difficulty in procuring it through application to his representative in Congress or to the Commissioner of Agriculture. The same volume will also contain hereafter the annual report of the Pomologist, the Mycologist, and the Botanist, of the Department.

The Entomological Division has also issued, from time to time, *Bulletins*, containing observations and experiments in its practical work, and studies and reports on special insects of exceptional importance. Bulletin No. 1 was published in 1883; No. 15, the last, in August of the present year. Application for these should be made to the Department of Agriculture.

The four *Reports of the United States Entomological Commission*, containing, in the aggregate, over 3,000 octavo pages and 150 plates and numerous figures, are mainly devoted to consideration of the Rocky Mountain locust and the Cotton-worm, while space is given (in vol. 3) to the Canker-worm — a notorious apple tree pest in some localities. In the fourth Report of the Commission, published by the Department of Agriculture (volumes 1 and 2 are from the Department of the Interior), no less than sixty-four pages are devoted to the interesting subject of insecticides, and 132 pages to machines and devices for their application to various crops under different conditions.

Of the *Bulletins* that have been issued by the Entomological Commission, No. 7, entitled *Insects Injurious to Forest and Shade Trees* (published by the Department of the Interior, in 275 pages), contains descriptions and figures of quite a number of pests which also extend their ravages to fruit trees, and would therefore be of value to the fruit grower. An enlarged and revised edition of this valuable volume is being prepared, and may be expected to appear during the coming year. As indicating the advance made in this promised revision, and also, in our general knowledge of insects, since the issue of the first edition in 1881, I will state, that while in that edition, 214 oak insects are enumerated, its author, Dr. Packard, informed me some months ago, that his manuscript then contained 425 determined species living on oak, and about 100 undetermined.

Of the valuable series of Reports of Dr. Asa Fitch, on the *Noxious and Other Insects of the State of New York*, published in the Transactions of the New York State Agricultural Society for the years 1854-1870, the first three are mainly devoted to fruit insects. Reports one and two, forming a bound volume, may be procured of the secretary of the State Agricultural Society, at Albany; report three is out of print. For information relating to the other eleven, my first report on the *Injurious and Other Insects of the State of New York*, pp. 294-296, may be consulted.

The nine *Reports on the Insects of Missouri*, by Prof. C. V. Riley, replete as they are with admirable life-histories and illustrations of notable excellence, are desirable to all who have occasion to study insect lives and insect habits; as are also the fourteen *Reports on the Insects of Illinois*, by the State Entomologists, Walsh, Le Baron, Thomas, and Forbes. It is hardly possible to obtain full series of these, but inquiries in relation to them may be addressed to Prof. Riley, at Washington, and to Prof. S. A. Forbes, State Entomologist of Illinois, at Champaign, Ill.

The American Entomologist — three volumes, of from 250 to 350 pages each, contains much material of pomological importance. The first volume is difficult to obtain, and consequently commands a high price (seven dollars) when offered for sale. Inquiries for these may be made of Prof. Riley.

A Monthly Bulletin, under the name of the *Practical Entomologist*, forming two volumes — pages 128 and 122 — was published in 1865-1867 by the American Entomological Society "for the dissemination of valuable knowledge among agriculturists and horticulturists." Possibly a few copies are still procurable of the secretary of the society, Mr. E. T. Cresson, P. O. box 1,577, Philadelphia, Pa.

To a number of other publications I would be glad to invite your attention, but it would too greatly extend my paper.

CONCLUSION.

I have attempted to show how the pomologist can hope to attain success in the insect warfare in which he must engage, and the panoply in which he should be clothed for the fight. The requirements that I have made are not very exacting, or are they difficult to meet. Compliance with them will not only yield a pecuniary reward, but at the same time add to mental wealth, enlarging and enriching the mind, by opening up to it sources of pleasure and continually increasing interest, as one is led from the simple contemplation of these curious, beautiful, and wonderful forms, to the remarkable transformations that they undergo, the various habits that characterize them, and the surprising instincts or the shadowing of reasoning powers that they not unfrequently display.

The study of the myriad insect world, even apart from its utility, can not fail of being a fascinating adjunct to the pleasurable pursuit of fruit growing. As such, I commend it to each member of the American Pomological Society.

(C.)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year (1887), giving title, place and time of publication, and a summary of contents:

The Praying Mantis and its Eggs. (Country Gentleman, for January 6, 1887, lii, p. 9, c. 3–4, figure — 62 cm.)

Egg-cases from Charlottesville, Va., where they occur on fences, are identified as of this insect and described. The mode of deposit of the eggs is not known, but probably the entire mass is extruded in its case. The perfect insect, *Mantis Carolina* Linn., is described and figured, and its habits, food, manner of feeding, etc., stated, together with its occasional cannibalism. It is a Southern form, not occurring in New York. Its consumption of injurious insects entitles it to protection and cultivation. [See revision and extension of above in pages 158–162 of this Report.]

A Bug Injurious to Shade Trees. (Country Gentleman, for January 27, 1887, lii, p. 69, c. 2–3 — 18 cm.)

Leptocoris trivittatus (Say)—one of the Hemiptera, received from Sterling, Kansas, where it has abounded during the autumn and winter, is described, and its habits in Topeka, Kansas, as narrated by Prof. Popenoe, quoted, together with its food-plants there observed, viz., box elder (*Negundo aceroides*) and soft maples. [See revision and extension of above in pages 156–158 of this Report.]

Fuller's Rose-Beetle — Aramigus Fulleri *Horn*. (Country Gentleman, for February 3, 1887, lii, p. 89, c. 1 — 21 cm.)

A grub sent from Bucksport, Maine, as destructive to the roots of rose-bushes, is Fuller's rose-beetle—known as being quite injurious to roses grown in greenhouses and to some other plants. Dr. Horn's remarks upon its rapid spread over the country following its first notice in 1874, are quoted. The grubs eat the roots and the beetles the foliage of the plants. The latter often abound in greenhouses in November and December, when they should be collected and destroyed. By carefully hand-picking the beetles as they mature, they may be exterminated. A bush badly infested at the roots should be taken up with proper care and burned. See Second Report on the Insects of New York, 1883, p. 142.

Harmlessness of the Lady-bird, Adalia bipunctata. (The Owl [Glens Falls, N. Y.], February, 1887, ii. p. 15—8 cm.)

The cause of the unusual abundance of this harmless insect in dwellings during the past winter, is its entrance for hibernation after its great abundance last year as a destroyer of the innumerable aphides which infested the hop and other crops. It deserves protection wherever met with.

The Aphididæ, or Plant Lice. (Proceedings of the Western New York Horticultural Society at its thirty-second annual meeting, January 26 and 27, 1887, pp. 85–97.) Issued in March, 1887.

The paper is arranged under the following headings: Systematic Position of the Aphididæ — Features of the Aphididæ — Distribution of the Aphididæ — Injuries from the Aphididæ — Propagation of the Aphididæ—Imperfect knowledge of the Aphididæ—Recent Discoveries.

A Wood-eating Insect. (Country Gentleman, for March 31, 1887, lii, p. 257, c. 1—18 cm.)

Inquiry made of a long-horned beetle which had recently appeared in a dwelling in Albany, in numbers, is answered by its identification as *Xylotrechus colonus* (Fabr.). Nothing is known of its life-history, except that it has been bred from oak and maple. It may have been carried within doors in the larval stage in fuel, or it may have emerged from furniture recently manufactured. Instances are recorded where beetles have escaped from furniture after their imprisonment for fifteen years. They may have come from the hickory wood stored (as stated) in the basement. [See revision and extension of the above in pages 93–96 of this Report.]

How to Prevent the Cabbage-maggot. (New England Homestead, for April 9, 1887, xxi, p. 136, c. 5—35 cm.)

No general preventive or remedy is known, as the materials used are variously affected by the character of the soil where applied. The following are discussed: Tobacco-dust sprinkled on the plants to prevent egg-deposit. Dressing the ground before planting with 150 bushels of shell-lime to the acre. Gas-lime worked into the soil. Ammoniacal liquor applied to the roots. Decoction of burdock stems and leaves. Decoction of tansy. Puddling the plants with a mixture of earth and cow-dung or night-soil. Dipping in soot and water. Dipping in hellebore solution. Avoid use of fresh barn-yard manure.—Reports of experiments with the above are requested.

Currant Worm Remedy. (Popular Gardening, for April, 1887, ii, p. 120–121—8 cm.)

An effectual remedy may be had in sprinkling powdered hellebore on the lower leaves of currant bushes when they first show the small holes eaten by the larvæ of the first brood; or the leaves may be picked off and crushed. Will distribute the egg-parasite, *Trichogramma pretiosa*, if the parasitized eggs can be obtained.

Life-history of Hemileuca Maia *Drury.* (The Swiss Cross, for April, 1887, i, pp. 135–139, figs. 1–3.)

Presents the life-history of this Bombycid moth under the following heads: The Egg-belt; Egg cement; Oviposition; Hibernation of the eggs; Hatching; Egg-shell; The young larva; First moult; Second moulting; Third moulting; Stinging power of the larva; Fourth moulting; Fifth moulting; Mature larva; Food-plants; Parasites; Pupation; The pupa; The Imago; Metamorphic periods; Prolonged pupation; Habits of the moth; Rarity; Geographical range.

The Apple-tree Bark-louse. (Country Gentleman, for April 21, 1887, lii, p. 321, c. 1–3 — 60 cm.)

Scales on apple bark from Batavia, N. Y., are those of *Mytilaspis pomicorticis* Riley. They often entirely cover the bark, giving it a characteristic blistered appearance. Description of them. Interest pertaining to the life-history of the insect. Is not fitted for rapid spreading, as the female is wingless, but may be conveyed by other insects, birds [and spiders]. The brief period of their free existence. Reference to scale-insects of the orange in Florida and California. For remedies, cut down and burn the trees infested throughout, or spray thoroughly with a kerosene emulsion. Small trees may be scraped. The most vulnerable time of the insect, is just after hatching, or at the time of the blossoming of the tree. Prof. Cook's method of scouring by hand with a soft-soap and carbolic acid solution. Soft-soap and washing soda also recommended; also, linseed oil.

Remarks, in answer to inquiry, on the two-spotted lady-bird, *Adalia bipunctata*, found frequently hibernating in houses, and mistaken for the carpet-beetle, *Anthrenus scrophulariæ*.

Borers in Timber. (Country Gentleman, for April 28, 1887, lii, p. 341, c. 3 — 17 cm.)

A correspondent asks for a method for protecting timber from borers. The inquiry is of too general a nature to admit of satisfactory reply. Means for protecting certain timber from specified insects could be given. The ship-timber in the royal dock-yards of Sweden, was, by the direction of Linnæus, preserved from *Lymexylon navale*, by submerging it at a specified time. Some felled timber may be protected by peeling the bark. Creosote has been used for protection of timber, with satisfactory result.

Honey-dew Eaten by Bees. (Country Gentleman, for April 28, 1887, lii, p. 341, c. 3–4 — 44 cm.)

The extent to which honey-dew is eaten by bees, is of entomological, botanical, and economical importance. A correspondent states that the aphis secretions on fruit trees and the elm is not eaten by bees. Prof. Cook is quoted on some honey-dews that are eaten. "Honey-dew," too general a name, as it includes both aphis and plant secretions. Sometimes difficult to determine the source of a secretion observed. An extract from "Science" is given, on the rich nectar and excellent bee-food secreted by the larch plant-louse, *Lachnus laricifex* Fitch, which is corroborated by Prof. Cook.

The Seventeen-year Locust — Cicada septendecim. (The Owl, Organ of Agassiz Association, No. 711, Glens Falls, N. Y., May, 1887, ii, pp. 17–19, figs. 1–5.)

The interest attaching to this insect from its long period of development, noticed; also, a thirteen-year Southern race; number of broods in the United States, and the number occurring in the State of New York; the next appearance of the New York broods. A résumé of the life-history of the insect is given, and reference made to *Cicada tibicen.*

[A Root Aphis of the Hop-vine.] (The Waterville [N. Y.] Times, for May 6, 1887, p. 2, c. 3 — 32 cm.)

Some insects sent in soil from a hop-vine hill in Waterville, are recognized as belonging to the group of *Rhizobiinæ*, or underground aphids, which feed on the roots of plants. They can not be referred to any described U. S. species, as they differ from all such. A description of them is given. They are viviparous females, and are now producing living young. As these develop, it may be possible to identify them with some known above-ground species.

Lady-birds, Leaf and Carpet Beetles. (Country Gentleman, for May 12, 1887, lii, p. 381, c. 1–3, figs. 1–6 — 80 cm.)

Importance of such a knowledge of lady-birds as should prevent such destruction as they have been recently subjected to from having been mistaken for the carpet-beetle; the regard for them in Europe; how their form and markings may serve for their recognition; the specific names that indicate their usual spotted ornamentation; figures of some species; how the *Chrysomelidæ* with which they are liable to be confounded, may be distinguished, particularly the "tortoise beetle;" the *tarsi* as separating and distinguishing the two families; description and figures of the carpet-beetle, *Anthrenus scrophulariæ.*

The Little Winged Pest. (The Albany Argus, for May 16, 1887, p. 2.)

An abstract from a paper read before the Dana Natural History Society of Albany, on the Mosquito, treating of the numerous species; their distribution; means of protection against them; the bite; palliatives of the bite; only the female bites; the biting organs; use of the mosquito; the mosquito as a host for filariæ; perhaps one of the ten plagues of Egypt; the life-history and transformation of the insect.

Another Apple-Tree Pest. (Country Gentleman, for May 19, 1887, lii, p. 398, c. 4 — 10 cm.)

A flea-beetle sent from Coleman's Falls, Va., where "it caused the apple-trees to look as if the buds had been burned out with a hot iron," is *Crepidodera rufipes* (Linn.). Although *C. Helxines* has been reported as injurious to apple leaves in Illinois, this has not previously been so reported. The reasons are given why neither of these may be expected to prove serious pests of the apple. [See revision and extension of the above in pages 101–103 of this Report.]

A New (?) Aphis on Hop Roots. (Country Gentleman, for May 19, 1887, lii, p. 401, c. 3–4 — 45 cm.)

Aphides received from Waterville, N. Y., are sent as probably the hop-louse. Importance of ascertaining the hibernation of *Phorodon humuli*, which is believed to be on plum trees. Our limited knowledge of the root-feeding *Rhizobiinæ*. Description of the mature and young aphis from hop hills in Waterville.

The Currant-worm Parasite. (Albany Express, for May 23, 1887, xli, p. 2, c. 5 — 10 cm.)

The attack of the egg-parasite [*Trichogramma pretiosa*] on the eggs of the currant saw-fly — not hitherto recorded out of the State of New York, is discovered in some of the eggs received from a fruit farm in Galena, Ill. In picking off for destruction the egg-bearing leaves of currant bushes, those on which the eggs have turned black, indicate parasitization, and therefore should not be crushed, but preserved for the development of the parasite.

The Leather Beetle. (Boots and Shoes Weekly, for May 25, 1887, xi, p. 473, c. 1–2 — 36 cm.)

To inquiry received from Scott Co., Ky., of an insect that burrows in shoes and perforates them in all directions (no examples sent), reply is made that it is probably *Dermestes vulpinus*, or "the leather beetle," which has seriously injured boots and shoes in some wholesale houses in St. Louis, Mo., and elsewhere. Its operations are described and remedies given. Another beetle occasionally injuring boots and shoes is *Sitodrepa panicea*. [See pages 88–93 of this Report.]

A Saw-fly on Apple-trees. (Country Gentleman, for May 26, 1887, lii, p. 421, c. 3 — 21 cm.)

Insects occurring in large numbers on apple-trees in Chester county, Pa., and thought to be the occasion of the blighting of the trees, are *Dolerus sericeus* (Say). They could not have caused the injury reported. *Dolerus arvensis* (Say) has been sent from Ohio as having injured the fruit-buds of pear-trees, but it is not credited, for none of the *Tenthridinæ* are known to feed injuriously on vegetation in their perfect stage. Reference is made to food-plants of the larva of *D. arvensis*.

Elm-leaf Beetle Going Northward. (Country Gentleman, for May 26, 1887, lii. p. 421, c. 3–4 — 20 cm.)

Galeruca xanthomelæna (Schr.) received from Poughkeepsie, N. Y.— the most northern locality in the State from which it has been reported. Its progress, since its introduction fifty years ago, is sketched. Importance of efforts to arrest its spread. Reference to literature upon the insect.

A New Cotton Pest. (Country Gentleman, for June 2, 1887, lii. p. 441, c. 4 — 19 cm.)

A small beetle reported from Jackson county, Ga., as destroying young cotton plants where ragweed had grown the preceding year, is

identified as *Systena blanda* var. *bitæniata* LeConte. This Chrysomelid beetle had not been known to injure cotton. It has been reported as injurious to corn in Pennsylvania. The Systenas (species cited) are not usually injurious to vegetation. For preventives, destroy the ragweed, or sprinkle the young cotton plants with any dust-like substance. [See pp. 155, 156 of this Report.]

Thrips in Strawberry Blossoms. (Country Gentleman, for June 9, 1887, lii, p. 459, c. 1–2 — 50 cm.)

Strawberry blossoms from Geneva, N. Y., contained thrips, averaging perhaps twelve to a blossom. Difference between the true thrips and the so-called thrips of the grape leaves; their appearance; where they occur; have not been much studied; conflicting statements of their habits; deemed by some to be mainly insectivorous and therefore beneficial; by others, injurious to vegetation; known feeding habits of some species quoted; the species undoubtedly differ in habits. No injuries evident in the Geneva blossoms. The strawberry thrips has been very abundant and injurious to the blossoms in Illinois, and is being studied by Professor Forbes.

The Leather Beetle again. (Boots and Shoes Weekly, for June 15, 1887, xi, p. 608, c. 1–3—50 cm.)

The beetle boring into shoes (see preceding page) has been reared from an infested shoe, and found to be *Sitodrepa panicea*. Its operations in the leather are described, and some of the large number of substances on which it feeds, given. It will not probably prove a very serious leather pest. In addition to the remedies suggested for *Dermestes vulpinus*, this may be killed in any of its stages by treating the infested shoes with kerosene.

The Apple Pest. (Oswego Daily Times, June 18, 1887, p. 4, c. 6–7—48 cm.)

Insects reported as entirely destroying the foliage of apple trees in Granby, Oswego county, N. Y., and eating the young fruit, are identified as the rose-bug, *Macrodactylus subspinosus*. This beetle is described, its occasional ravages referred to, and the difficulties in dealing with it, pointed out. The best methods for its control, are beating from low plants into a pan of water and kerosene, and jarring from trees on sheets spread beneath: also dusting the foliage with oak ashes (highly recommended), air-slacked lime, plaster of Paris, or even with road-dust. The insects will disappear about the first of July.

Cockscomb Elm-gall. (Country Gentleman, for June 23, 1887, lii, p. 491, c. 2 — 12 cm.)

Galls on young elm trees in Coffee, Va., are the above species, *Glyphina ulmicola* (Fitch); description of them; are confined to the white elm, *Ulmus Americanus*. For remedy, when the insects are distributed over the leaves, spray with soapsuds and quassia water, or a kerosene emulsion. Reference to literature of the gall.

The Ox Warble-fly. (Country Gentleman, for June 23, 1887, lii, p. 493, c. 1–3 — 106 cm.)

What warbles are; different species of warble-flies; figure and description of the ox warble-fly and its life-history; habits of the larva and figures. The best method of dealing with this insect is to kill the maggot in March and April by applying to the opening in the warble a little mercurial ointment. Reference to the old method of forcing out. The ointment sometimes applied before openings appear. Other thick adhesive material that may be applied to arrest respiration. Natural history of the insect. Applications for prevention need to be long continued, and are, therefore, not as simple as killing. Some preventives named. Reference to, and figure of, the ox gad-fly, *Tabanus bovinus* Linn.

Grape-vine Leaf-hopper. (Country Gentleman, for June 23, 1887, lii, p. 493, c. 4 — 33 cm.)

Insects destroying grapevines in Clearfield, Pa., are not "thrips" as commonly named, but species of *Erythroneura*, of the Hemiptera; the general appearance and operations of these leaf-hoppers; a common one is the *Tettigonia vitis* of Harris, which is described. The young leaf-hopper may be killed with soapsuds, or tobacco water, or the kerosene emulsion. When winged, they may be driven on a piece of building-paper coated with gas-tar stretched between the rows of the vineyard.

The Rose-Bug. (Country Gentleman, for June 30, 1887, lii, p. 511, c. 1–2 — 35 cm.)

Rose-bugs from Onondaga county, N. Y., and Cumberland county, N. J., attacking peach, corn, grape, and blackberry are identified. No means for fully controlling it yet known; is a local insect, and believed to breed in sandy soil. Beating and jarring from plants and trees has long been practiced successfully. When on corn might be poisoned with Paris green or London purple. Dusting the foliage with some dry powdery substance is a good preventive. Lures for concentrating attack are the Clinton grapevine and valerian. Account of the success of the last-named lure.

The Hop-Louse. (Country Gentleman, for June 30, 1887, lii, p. 511, c. 2–3 — 23 cm.)

In answer to request for remedies for *Phorodon humuli*, reply is made that none will probably be needed this year. In years of its abundance, the English custom of hop-washing will have to be adopted in this country, to insure remunerative crops. The machine used in England for this purpose is described, and the wash of quassia extract, soft-soap and water given. Reference made to present investigations in the life-history of this insect by the Division of Entomology at Washington.

Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1885. (Thirty-ninth Annual Report of the State Museum of Natural History, for the year 1885, pp. 77–125.) [Published, July 6, 1887.]

The contents are, Introduction. Publications by the Entomologist. Contributions to the Department. Collections of the entomologist. Insect Attacks and Miscellaneous Observations [as follows]: Eggs of a Cut-worm on an apple-tree: The Canker-worm: The Apple-leaf Bucculatrix: The Clover-seed Midge: Sciara sp? on wheat: Helophilus similis: The Cabbage Fly: The Hessian Fly: A Lady-bug attack on scale insects: Oviposition of Saperda candida: The Clover-leaf weevil destroyed by a Fungus attack: The Pear-blight Beetle: Attack on young pears by a Plant-bug: Pœcilocapsus lineatus: An Experiment with the 13-year Cicada: A Scale-insect attack on Ivy: The Cheese-mite infesting Smoked Meats: A Parasitic Mite infesting a beetle: A Mite attack on Garden plants: The Black Knot of the Plum tree and its Guests. Notes upon various Insects [as follows—reprinted in present report]: Nisoniades Persius—Sphinx Canadensis—Melittia cucurbitæ—Tinea pellionella—Mallota sp.—Anthrenus scrophulariæ—Thanasimus dubius—Macrodactylus subspinosus—Chrysochus auratus—Trirhabda Canadensis—Hylesinus opaculus—Phlœotribus liminaris—Œcanthus niveus—Ephemera natata.

The Meal Worm in Salt. (Country Gentleman, for July 7, 1887, lii, p. 530, c. 3–4 — 8 cm.)

Examples of twenty-five larvæ and of some beetles found in a sack of salt which had stood unopened in a meal-room for two months, in Newark Valley, N. Y., are *Tenebrio molitor* Linn. It is probable that the larvæ entered the sack for pupation, and in this manner only could the salt have served any purpose in the development of the beetle from the matured larvæ.

Four-lined Leaf-bug on the Currant. (Country Gentleman for July 14, 1887, lii, p. 547, c. 2–3 — 21 cm.)

Insects infesting currant bushes at Fairmount, N. Y., are *Pœcilocapsus lineatus* (Fabr.). Description of it is given and of its method of injury. It can not be killed by application to the leaves, as it is not a suctorial insect. Remedies mentioned, are, burning refuse garden material where it hibernates, killing the hibernating female when returning to the bushes in early spring for oviposition, and beating the larvæ and pupæ into a pan of water and kerosene.

The Elm-leaf Beetle. (Country Gentleman for July 21, 1887, lii, p. 565, c. 3 — 25 cm.)

Larvæ sent from Scarsdale, N. Y., as destroying the foliage of elms, are those of *Galeruca xanthomelæna*. References to former notices of it in the Count. Gent. The best liquid preparation for its destruction

is made with one-half pound of London purple, and three quarts of flour to a 40-gallon barrel of water. The method of mixing it is given, and the time for its application.

The Curculio on the Apple. (Country Gentleman, for July 21, 1887, lii, p. 565, c. 3–4 — 23 cm.)

Apples from Moosehead City, N. C., submitted for examination, are gnarled and distorted from the numerous blackened pits that they bear, which are particularly described No insects are found in the fruit. The punctures were probably made by the plum curculio, *Conotrachelus nenuphar*, for feeding purposes. The apple curculio, *Anthonomus quadrigibbus*, is described. Curculio attack is to be met by jarring the insects from the trees on sheets spread underneath.

An Ichneumonized Caterpillar. (Country Gentleman, for September 1, 1887, lii, p. 673, c. 3–4 — 13 cm.)

Darapsa Myron larva, from a grapevine at Nassau, N. Y., has its body covered with the cocoons of a small ichneumon fly, which is *Apanteles congregatus*. The history of this common parasite of *D. Myron* is given, with reference to an error that is often made of mistaking its cocoons for insect eggs and destroying them.

Milkweed Beetle with Bad Habits. (Country Gentleman, for September 1, 1887, lii, p. 673, c. 4 — 27 cm.)

Larvæ sent from Chenango Co., N. Y., as feeding commonly on the morning-glory, but also on barley, corn, cabbage, and some weeds are identified as those of *Chelymorpha Argus* Licht. The beetle is described. The literature of its food-habits is given, showing that it had not hitherto been observed as a corn depredator. It does not promise to be destructive to valuable crops. When numerous it may be controlled by hand-picking or shaking from the plants.

Blister Beetle Attack. (Country Gentleman, for September 1, 1887, lii, p. 674, c. 2 — 6 cm.)

A beetle from Morton, Pa., charged with having devoured in one night the leaves of a *Clematis flammula*, is identified as *Epicauta cinerea* (Forst.), the *marginata* of Fabricius. Remedy, spraying with Paris green in water.

Mites on Arbor Vitæ. (Country Gentleman, for September 1, 1887, lii, p. 674, c. 3 — 9 cm.)

The blackened appearance of a twig of Siberian arbor vitæ, sent with inquiry from Pittsburgh, Pa., is due to an attack of a minute mite, the egg-shells and exuviæ of which are discernable under a magnifier. The attack can be arrested by spraying with pyrethrum water, or if on small trees by sulphur burned underneath with sheets spread over them to confine the fumes.

Harvest Fly. (Country Gentleman, for September 1, 1887, lii, p. 674, c. 3—5 cm.)

Identification of *Cicada tibicen*—the common harvest-fly, improperly known as a locust, with brief notice of its distribution from New York to Brazil; its annual appearance about the commencement of the dog-days; its shrilling noise, and the apparatus by which produced; its transformations, occupying two or three years, unlike the *Cicada septendecim* which requires seventeen years; its split pupal-cases often met with on the trunks of the trees.

Elm-leaf Spraying. (Country Gentleman, for September 8, 1887, lii, p. 694, c. 2-3—10 cm.)

In reply to an inquiry for a force pump for spraying elm trees, statement is made that a powerful pump is desirable that the liquid may be taken from a tank, and distributed through a rubber hose of suitable length and a "bamboo extension rod," as recommended in the U. S. Agricultural Report of 1881-82. The best nozzle to apply to the rod would be the "Nixon;" made at Dayton, Ohio, by A. H. Nixon. Bulletin No. 10, of the Division of Entomology, is referred to as giving method of elm-tree spraying practiced in Washington, D. C.

Pests of the Pomologist. (The Boston Herald, for September 16, 1887, p. 3—1¼ cols.)

Abstract of an address delivered before the American Pomological Society, at its meeting at Boston, September 15, 1887, treating of plant diseases and insect ravages, as the result of the present extended cultivation of fruit; great increase of fruit-pests from importation and changed food-habits, as shown in the fruit pests of California, and notably the "fluted scale;" the number of insect pests; importance of their study; some requisites of the successful fruit grower. The same in the Albany Sunday Express for October 2, 1887, p. 2, c. 4-5—1½ cols.

A Queer Foe to the Caterpillar. (New England Homestead, for October 1, 1887, p. 354, c. 3—13 cm.)

A Sphinx caterpillar having its body nearly covered with small, white parasitic cocoons, is the *Darapsa Myron* of the grapevine. The method of attack of the hymenopterous parasite, *Apanteles congregatus* is described, together with the development of the grubs within the body of the caterpillar, and externally within their cocoons. The cocoons are often mistaken for eggs. Caterpillars ichneumonized in this manner often have their larval stage considerably prolonged.

The Value of Crustaceans as Food for Fishes. (The American Angler for October 8, 1887, p. 235—31cm.)

In addition to the species and families of Crustacea named,—among the insects, May-flies, Phryganid larvæ and other aquatic larvæ are noticed, as very desirable food for fishes.

The Two-marked Tree-hopper. (Country Gentleman, for October 13, 1887, lii, p. 783, c. 2–3 — 22 cm.)

Insects described, sent from Glen Cove, Long Island, N. Y., as occurring only on *Juglans rupestris*, are a variety of *Enchenopa binotata* (Say). Comparison is made with typical examples of this species, and if the differences are constant, the form sent will at least merit a varietal name. They resemble examples of *Enchenopa* taken from a honey locust at Bennington, Vt. *Juglans rupestris* is native to Texas, Arizona, and New Mexico. Remedies for this insect are, removing and burning the twigs bearing the egg-deposits, indicated by the conspicuous white egg-coverings, and driving away the timid winged forms.

Mites on Arbor Vitæ. (Country Gentleman, for October 20, 1887, lii, p. 800, c. 2—8 cm.)

The mite infesting an arbor vitæ as noticed in the Country Gentleman for September first, is believed to be *Tetranychus telarius*, "the red spider," or a nearly allied species. Its occurrence on this food-plant is new.

Asparagus and Pear-Blight Beetles. (Country Gentleman, for October 27, 1887, lii, p. 817, c. 3–4 — 35 cm.)

Beetles appearing, for the first, this year at Annapolis, Md., are identified as *Crioceris asparagi*. Its distribution in this country is stated, and for remedies air-slacked lime, and chickens as collectors, recommended.

The beetles taken while commencing to bore in the trunk of a young apple tree, are *Xyleborus pyri* (Peck). Its two forms of attack — the burrowing of the larva near and into the bud, and by the mature beetle in the spring, into the trunk, are described. Remedies: cutting off and burning infested twigs, and poisonous or repellant washes.

White Grub Attack on Wheat. (Country Gentleman, for October 27 1887, lii, p. 817, c. 4 — 24 cm.)

A white grub sent from Abingdon, Va., where in October, it is destructive to young wheat, seems not to be that of *Lachnosterna fusca*, but of some allied species. Description of the grub is given, and of its method of traveling on its back. No remedy is known for an attack of this kind. The grubs should have been destroyed when the meadow was broken up for wheat, by methods mentioned. Should the grubs, after heavy rains, show themselves above ground, poultry would reduce their number materially.

The Bag-Worm. (Country Gentleman, for November 3, 1887, lii, p. 837, c. 2–4 — 54 cm.)

An insect destroying an arbor vitæ hedge in Plainfield, N. J., is the bag-worm, *Thyridopteryx ephemeræformis*, of which the habits are given, and reference to its bag; also, the degraded habits of the female;

reference to publications on it; the life-history; conflicting statements of transformations, etc., by Mrs. King; evidences opposed to those, and showing an autumnal maturity. Remedies are, poisoning with the arsenites, and collecting the bags in January for burning.

Insects and Yellows in the Peach. (Country Gentleman, for November 3, 1887, lii, p. 837, c. 4 — 22 cm.)

The beetle which "inspectors for peach-yellows" find in peach-trees in Ringwood, Ontario, and claim to be reason for condemning the trees as affected with yellows, is identified as *Phlœotribus liminaris* (Harris). It was many years ago thought to be associated with, if not the cause of, the yellows. It is not evidence of the disease. It is said to infest elms, and is known as the "elm-bark beetle." It occurs on peach-trees where yellows is unknown. Prof. Penhallow's studies of the disease show that it is not even induced by *Scolytidæ* presence. Reliable indications of the yellows, drawn from foliage, growth, and fruit, are cited.

Grape Insects in Manure. (The American Garden, for December, 1887, viii, p. 396, c. 2 — 7 cm.)

A recent statement attributing the increase of grape insects in the vicinity of New York city, to the use of city stable manure, is unworthy of consideration. Larvæ living on excremental material, would not feed on living plants. *Ligyrus relictus* larvæ which occur in manure beds have been mistaken for the white grub of *Lachnosterna fusca*, and excited fear that its distribution in manure would endanger field-crops. Such fears are groundless.

Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1886. (Fortieth Report of the N. Y. State Museum of Natural History, 1887, pp. 79–154. Also, separate, with cover and title-page: same paging.) [Published January 20, 1888.]

The contents are: Introductory: A new Attack on Wheat by a Saw-fly larva: The Red-humped Apple-tree Caterpillar and Parasite: The Forest-tent Caterpillar: The Spring Canker-worm: An Unknown Grass Pest: A New Strawberry Insect: A Meal Insect: A Grass-burrowing Insect: A Dung Beetle: The Sugar Maple Borer: The Potato-stalk Weevil: An Ugly Bee-Slayer: Melon Vines Attacked by the Squash-bug: The Grain Aphis: The Hop-vine Aphis: The Apple-tree Aphis: Potato Plants Attacked by Aphides: Aphis Attack on Carrots and Parsnips: The Beech-tree Blight: The Cockscomb Elm-gall: An Unrecognized Insect Attack: A Grass-Infesting Mite: A Mite Infesting Smoked Meats: Myriapod Attack on Potatoes: Notes on Various Insects: Contributions to the Department: List of Publications of the Entomologist during the Year.

(D.)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the contributions that have been made to the Department collections during the year:

IN HYMENOPTERA.

Pelopœus cœmentarius (Drury), *Pelopœus cœruleus* (Drury), and *Ophion bilineatus* Say. From Mrs. E. B. SMITH, Coeymans, N. Y.

Isosoma hordei (Harris) — the larvæ in wheat straw, September 7th. From C. H. BOYD, Johnson's Creek, Niagara county, N. Y.

Undetermined species of the Chalcid genera of *Torymus*, *Tetastrichus*, and *Entedon*, obtained from galls of *Cecidomyia betulæ*, contributed by PETER INCHBALD, Fulwith Grange, Harrowgate, Eng.

Rhyssa (*Thalessa*) *lunator* (Fabr.). From MONROE CRANNELL, Albany, N. Y.

The Oak plum-gall, containing larvæ of *Cynips q. prunus* Walsh, on the acorn cup of *Quercus rubra*, October 26. From AUGUSTUS FLOYD, Moriches, N. Y.

Woolly-galls on scrub oak, *Quercus nigra*, disclosing *Cynips q. operator* O. S. From Dr. M. G. PLANCK, Schenectady, N. Y.

Larvæ of the larch saw-fly, *Nematus Erichsonii* Hartig, from tamaracks at De Kalb Junction, St. Lawrence county, N. Y., June 29th. From C. PHELPS, De Kalb. Larvæ of the same, and cocoons spun en route, July 9th. From Rev. HENRY U. SWINNERTON, Cherry Valley, Otsego county, N. Y.

Dolerus sericeus Say, from apple tree blossoms. From JOHN L. BALDERSTON, Kennett Square, Pa.

Eggs of *Nematus ventricosus* Klug, parasitized by *Trichogramma pretiosa* Riley, May 16th. From HALLETT & SON, Galena, Ill.

Tips of currant twigs girdled and broken down, and found to contain young larvæ of an insect apparently belonging to the Hymenoptera, May 30th. From Prof. CHARLES H. PECK, Menands, N. Y.

IN LEPIDOPTERA.

Sphinx quinquemaculata Haworth — a female specimen captured September 28th. From Mrs. JOHN BLAIR, Albany, N. Y.

Spilosoma virginica (Fabr.); *Hyperchiria Io* (Fabr.); *Leucania pallens* Guen.; *Angerona crocotaria* (Fabr.); *Nematocampa filamentaria* Guen.; *Bleptina* sp.; *Rivula propinqualis* Guen.; *Acidalia* sp.; *Penthina nimbatana* (Clem.); *Carpocapsa pomonella* (Linn.); *Ephestia interpunctella* Zeller. From Mrs. E. B. SMITH, Coeymans, N. Y.

Larvæ of *Lagoa opercularis* (Sm.-Abb.), from an apple tree, with cocoons spun en route, August 19th. From C. R. MOORE, Birds Nest, Va.

Limacodes pithecium (Sm.-Abb.) — larvæ from apple tree and cocoon, August 24th. From HENRY C. GETTER, Middleburgh, N. Y. The same larva from a pear tree, with a cocoon, August 6th. From JOHN CORBETT, Watkins, N. Y.

Eggs of *Callosamia angulifera* (Walker). From Miss EMILY L. MORTON, Newburgh, N. Y.

Young larvæ of *Mamestra picta* Harris, feeding in company on currant leaves. From GEORGE T. POWELL, Chatham, N. Y.

Larvæ of *Nephelodes violans* Guen., collected alive from the surface of snow, near Montreal, Can., March 18th. From Prof. D. P. PENHALLOW, McGill University, Montreal.

Aletia xylina (Say), the cotton-worm moth, from large numbers abounding about electric lights and in windows in Watertown, N. Y., on October 10th. From J. Q. ADAMS and from J. M. ADAMS, of Watertown.

Zerene catenaria (Cramer), in several examples, captured at light on windows in Albany, September 21st. From ERASTUS CORNING, Jr., Albany, N. Y.

Larvæ of *Anisopteryx pometaria* Harris, from apple-trees. From AUGUSTUS FLOYD. Moriches, N. Y.

Larvæ of the eye-spotted bud-moth, *Tmetocera ocellana* (Schiff.), feeding within the buds and blossoms of apple twigs. From W. J. BABCOCK, Rochester, N. Y.

Larvæ of *Crambus* sp.? taken from roots of corn, June 23d. From W. E. HARDING, Bethany, N. Y.

IN DIPTERA.

Galls of *Cecidomyia betulæ* Winn., in the seeds of white birch, *Betula alba*. From PETER INCHBALD, of Fulwith Grange, Harrowgate, England.

Lasioptera vitis O. S., emerging from galls on tips and leaves of seedling grape, June 7th. From HENRY LEE, Middlehope, Orange county, N. Y.

Sarcophaga sp.? and other undetermined *Muscidæ*. From Mrs. E. B. SMITH, Coeymans, N. Y.

Chloropisca prolifica Ost. Sack., in many examples, infesting a dwelling during the winter. From Warren F. Daniell, Franklin, N. H. The same species, September 18, from Dr. H. C. Coon, Alfred Centre, N. Y.

Pupæ of a leaf-miner within the leaves of daisies (*Chrysanthemum*) in a green-house at Glen Cove, N. Y., disclosing *Phytomyza lateralis* Fallen. From Dr. James A. Cooley, Glen Cove.

In Coleoptera.

Tenebrioides Mauritanica (Linn.), in larva, pupa, and imago, June 30, From J. M. Adams, Watertown, N. Y.

Alaus oculatus (Linn.) and *Lucanus dama* Thung. From Mrs. E. B. Smith, Coeymans, N. Y.

Larvæ of *Agriotes mancus* (Say), from corn. From D. A. A. Nichols, Cleveland, O.

Stodrepa panicea (Linn.), boring and breeding in shoes. From Wm. Smith, Louisville, Ky. The same insect, from a drug store, from J. M. Adams, Watertown, N. Y.

Phanœus carnifex (Linn.), collected at Columbus, O. From Frank Phisterer, Albany, N. Y.

Macrodactylus subspinosus (Fabr.), from peaches and corn. From Charles E. Daboll, Memphis, N. Y.

Larvæ of *Lachnosterna* sp., allied to *L. fusca*, from roots of wheat. From R. P. Carson, Abingdon, Va.

Monohammus confusor Kirby, from Mt. Desert, Maine. From Miss A. McNaughton, Albany, N. Y.

Saperda vestata Say. From Harry L. Peck, Menands, N. Y.

Oberea bimaculata Oliv., the raspberry-cane borer — the imago, and the pupæ and the larvæ in their burrows, and girdled tips of the canes. From J. E. Blodgett, Oswego, N. Y.

Lema trilineata (Oliv.), in larvæ in various stages, and the beetle, feeding on *Physalis*. From E. S. Goff, and from M. H. Beckwith, of the State Agricultural Experiment Station, at Geneva, N. Y.

Galeruca xanthomelæna Schr.— the elm-leaf beetle. From Isaac Coles, Glen Cove, N. Y.; from E. S. Grove, New York city ; and from D. J. Garth, Scarsdale, Westchester county, N. Y.

Eggs of *Galeruca xanthomelæna* Schr. From Mrs. E. W. K. Lasell, Orange, N. J.

Systena blanda var. *bitæniata* Lec., from cotton plants. From W. L. Williamson, Harmony Grove, Ga.

Pupæ and imago of *Chelymorpha Argus* Licht., from corn, July 15. From C. L. Landers, Afton, N. Y.

Tenebrio molitor (Linn.). From J. M. ADAMS, Watertown, N. Y.

Epicauta cinerea (Forst.), from *Clematis flammula*. From E. RAMSDEN, Morton, Pa.

Larvæ of *Conotrachelus cratægi* Walsh, in quinces. From MAXWELL and BROTHERS, Geneva, N. Y.

Scolytus rugulosus Ratz., in bark of peach trees. From GEORGE O. TOMPKINS, White Plains, N. Y.

Phlœotribus liminaris (Harris), in bark of peach trees. From E. F. OATES, Ringwood, Ontario.

IN HEMIPTERA.

Leptocoris trivittatus (Say), from Sterling, Kansas. From J. MILTON MOORE, Sterling, K.

Corythuca ciliata (Say), in larva, pupa, and imago, on *Platanus occidentalis*. From Prof. D. S. MARTIN, New York city.

Belostoma Americanum Leidy. From C. A. RICHARDSON, Canandaigua, N. Y.; from A. G. RICHMOND, Canajoharie, N, Y., June 28; from J. M. ADAMS, Watertown, N. Y.; from Dr. B. D. SKINNER, taken from under ice in fresh water, February 22, at Greenport, N. Y.

Apple twigs with inserted eggs of the buffalo tree-hopper, *Ceresa bubalus* Fabr. From E. L. GOFF, N. Y. Agricultural Experiment Station, at Geneva, N. Y.

Schizoneura sp., probably *tessellata* Fitch. From JOHN B. JOHNSTONE, Belmont, N. Y.

Galls of *Glyphina ulmicola* (Fitch), the cockscomb elm-gall. From S. H. HUBBARD, Coffee, Bradford county, Va.

Chionaspis furfurus (Fitch), the scurfy bark-louse, from apple trees. From C. R. MOORE, Birds Nest, Va.

IN ORTHOPTERA.

Egg-packet of *Mantis Carolina* Linn. From C. R. MOORE, Birds Nest, Va.

IN NEUROPTERA.

Larvæ of the "Hellgrammite fly," *Corydalis cornutus* Linn., September 23. From SELWYN A. RUSSELL, M. D., Albany, N. Y.

Diplax obtusa Hagen, from Round Lake, Saratoga county, N. Y. From S. C. BRADT, Albany, N. Y.

IN MYRIAPODA.

Cermatia forceps Raf., young, September 29. From ERASTUS CORNING, Jr., Albany, N. Y. From W. W. HILL, Albany, N. Y.

Lithobius Americanus Newport, and *Cermatia forceps* Raf., from the Industrial School Building. From Miss L. A. MARSHALL, Albany.

Iulus cœruleocinctus Wood. From Mrs. IRA HARRIS, Loudonville, N. Y.

(E.)

ERRATA IN FORMER REPORTS.

The following Errata in the First and Second Reports on the Injurious and other Insects of the State of New York, were not noted in a number of the copies that were first distributed. They may be cut from this page and inserted in the volumes:

[Of First Report.]

Page 42, line 34, and page 247, line 15, *dele* the comma after *cerasi* and *opimus*.
Page 81, lines 5, 6, 7, 17, *dele* the period after the specific name.
Page 81, line 27, for ii, read iii, 1883.
Page 87, line 3 from bottom, for ii, read iii, 1883.
Page 160, line 28, for BUCCULATRIX read BUCCULATRICIS, and correct in Index.
Page 215, line 34, change the comma to a period.
Page 226, line 35, after different insert class of the.
Page 296, line 21, read two of the three bound volumes.
Page 349, *dele* the comma from Bucculatrix, pomifoliella.

[Of Second Report.]

Page xii, line 15, for *rœus* read *reus*.
Page 31, line 3 from bottom, for *Pscyche* read *Psyche*.
Page 46, line 15, for Mille read Miller.
Page 57, line 2, for Harris read (Harris).
Page 74, line 31, for *Thyriodopteryx* read *Thyridopteryx*.
Page 77, line 4, for *Cupili-* read *Cupuli-*.
Page 94, line 1, for **Grote** read Grote.
Page 98, line 35, for honey-locust read common locust.
Page 101, line 2, same as the above.
Page 101, line 4, for *Spiraæ* read *Spiræa*.
Page 102, line 30, for 169 read 171.
Page 119, line 13, for on read in.
Page 119, line 17, for where read when.
Page 140, line 4, for Rhynchoporid read Rhynchophorid.
Page 140, line 25, for pora read phora.
Page 142, line 1, for (Horn) read Horn.
Page 182, line 9, for longer read shorter.
Page 199, line 8, for *Pscocidæ* read *Psocidæ*.
Page 223, line 9, for *aurichalchea* read *aurichalcea*, and correct in Index.
Page 235, line 6, *dele* the first with.
Page 264, line 15, *dele* 98.

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ERRATA.

Page 14, line 13 from bottom, for J. W. read W. J.

Page 34, line 24, for 148 read 28.

Page 39, last line for (Dade.) read (Gade.)

Page 52, line 9, for *Quercus vaccinium* read *Quercus, Vaccinium.*

Page 73, first line, for (Fallen) read Fallen.

Page 107, line 27, for *Tingi shyalina* read *Tingis hyalina.*

Page 113, line 6 from bottom, for *MS.* read (*MS.*

Page 119, line 6 from bottom, for *Michigan* read *Michigan.*)

Page 145, line 18 from bottom, for *Americana* read *Americanum.*

Page 156, first foot-note, for Saunder's read Saunders'.

Page 166, line 18, for biographical read bibliographical.

Page 181, in foot-note, for 283–292 read 163–172.

Page 198, line 3 from bottom, for *Americanus* read *Americana.*

Page 200, line 10 from bottom, for is not a read is a.

Page 200, line 12 from bottom, for *Pœcilocap-* read *Pœcilocap-.*

[From the 42d Report of the New York State Museum of Natural History.]

FIFTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK.

Made to the Regents of the University, Pursuant to Chapter 355, of the Laws of 1883.

By J. A. LINTNER, Ph. D., State Entomologist.

ALBANY:
THE TROY PRESS COMPANY, PRINTERS.
1889.

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No. 68.

IN SENATE,

FEBRUARY 28, 1889.

FIFTH REPORT

OF THE

STATE ENTOMOLOGIST ON THE INJURIOUS AND OTHER INSECTS OF THE STATE OF NEW YORK.

OFFICE OF THE STATE ENTOMOLOGIST,
ALBANY, *February* 25, 1889.

To the Legislature of the State of New York:

I have the honor to present to the Legislature, my Fifth Report on the Insects of the State of New York, which is also presented to the Regents of the University, as required by law.

Very respectfully,

J. A. LINTNER.

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REPORT.

OFFICE OF THE STATE ENTOMOLOGIST,
ALBANY, *December* 11, 1888.

To the Honorable Board of Regents of the University of the State of New York:

GENTLEMEN.— In accordance with chapter 355 of the Laws of 1883, I beg leave to present to your honorable board the following report embracing, results of my studies and observations on the Insects of the State of New York during the year 1888:

Interesting insect attacks of an unusual number have presented themselves for study, of which by far the larger number have been upon our fruit crops. While it is evident to all who are engaged in agricultural pursuits that insect depredations are annually increasing in our country, both in the number of pests and in the aggregate of the losses that they occasion, it is equally evident to the entomologist, who is specially charged with the study of these depredations, that the increase in new forms of attack lies largely in the direction of fruit pests. A sufficient reason for this may be found in the increasing attention that is being given to fruit culture, and its remarkable extension, as a commercial interest, year by year. How such extension in the production of special crops tends to augment insect ravages in still greater proportion, has been shown by me in former reports and needs not to be repeated at the present.

Several of the new attacks are still under study and have not progressed sufficiently to warrant present report upon them. Of these are two forms of insect injury to fruits and fruit trees which have for years been an enigma to us, but have found their explanation during the past summer, although not yet assigned to the particular species which cause the injury. In one, the young fruit of the apple and pear, and perhaps the quince, are pitted, become gnarled, often distorted, and fail of development even when they remain upon the tree; in the other, the trunks and

limbs of fruit trees show areas of different sizes, varying from a fraction of an inch to several inches, in which the sapwood is killed so as to disclose patches of the dead inner wood from over which the bark has broken away, leaving deeply depressed dead portions, around the margin of which the annual growth of sapwood following the injury builds up an irregular wall.

An extraordinary multiplication of a common fruit-tree pest, the apple-tree tent-caterpillar, *Clisiocampa Americana*, during the past summer in the State of New York was such a phenomenal event as to draw wide-spread attention to it. There is no record of its ever having appeared before in such enormous numbers over so extended a territory. Apple orchards in the eastern counties of the State, and in portions of New England and New Jersey, were only saved from defoliation through much earnest labor. Where it had not been thought necessary to contend with the caterpillar, as in its occurrence on the wild cherry and other trees upon which it feeds, the leaves were eaten to the last fragment, and the defoliation was as complete as if they had been swept by fire. In passing through the country a prominent feature of the landscape was the multitude of these leafless trees in midsummer, bearing in the forks of their branches the white web nests to the number often of from twenty to forty in a single tree, which the caterpillars had built up for their shelter at night and during rains.

In connection with the above reference to fruit pests, it may be of interest to state that injuries from the same source have been reported in England the present year, to even a greater extent than with us. Miss Ormerod, the eminent entomologist of the Royal Agricultural Society of England has written me: "The orchards in our fruit-growing counties were in some cases devastated by the hordes of Lepidopterous caterpillars of various kinds that swept off the foliage — in some instances even killing the trees." Mr. Charles Whitehead, Agricultural Adviser to the Agricultural Department of England, has recently reported as follows: "In many of the principal fruit-producing districts, caterpillars have lately caused most serious injury to apple, pear, plum, damson, filbert, and other fruit trees, so that in some cases the whole crop has been lost. When the blossom buds and leaf buds began to unfold, it was seen that they were attacked by legions of caterpillars. Soon the blossoms and leaves were entirely devoured, or

so much injured as to be useless. The fruit plantations in parts of Kent, Hereford, Worcester, and some other counties where fruit is extensively grown, looked as if a hot wind had passed over them."

Grain nor grass crops have not suffered to any unusual extent. Injury to June grass (*Poa pratensis*) through a thrips attack, which has been noticed for several years, in which the larva extracts the juices from the upper joint of the grass at its base, causing its speedy withering and drying up, is apparently increasing and largely extending its range. A similar attack on Timothy grass (*Phleum pratense*) has been reported from Canada the present year, and has also been observed by me in Albany county. I have failed in my effort to rear the larvæ to the perfect stage, and thereby verify or disprove my belief that the Timothy insect is identical with that which for a long term of years has been infesting June grass,* to which Professor Comstock some time since gave the MS. name of *Limothrips poaphagus*, and has recently published its characteristic features.

A feature of the year has been a remarkable exemption from aphis injuries. The hop crop was unusually free from aphis presence — in striking contrast with its excessive abundance and destructiveness in 1886. Not a single complaint was received by me of aphis injury to apple trees at the opening of the season when almost annually the insect threatens the destruction of the starting buds and the unfolding leaves. In a few cases only was aphis attack of any kind reported, and then merely to some of the minor garden crops.

In several portions of the State, the Colorado potato-beetle was very abundant, showing that the pest is not disposed to abandon the territory which it has occupied for a number of years, and that it is still necessary to meet it persistently with the arsenical insecticides, which, properly used, are adequate to its control.

There has been a notable increase in the operations of the oak-pruner, *Elaphidion parallelum* Newman., in the southeastern portion of the State, in cutting off the ends of the branches and dropping them to the ground. A number of reports of its injuries — not only to oaks but also to maples — have been received from localities on Long Island. In one instance where the attacked

* Report of the State Entomologist to the Regents of the University, S. N. Y., for 1886, pp. 96-98.

trees were serving as ornaments of a lawn, it had been necessary to gather the pruned tips and branches from the ground from time to time, and carry them away by the cart-load for burning. From features shown in the excised material sent me, it is thought that more than one species of *Elaphidion* may have been engaged in these attacks. This will be ascertained when the beetles have been reared from the infested twigs.

From several sections of the State, as notably from Jefferson county, unusually severe attacks from the rose-bug, *Macrodactylus subspinosus* (Fabr.), have been reported—in some instances destroying both the foliage and the fruit of the plum, the cherry, and the grape.

Fuller's rose-beetle, *Aramigus Fulleri* Horn, a destructive curculionid beetle, but fortunately of only local distribution, has occasioned considerable trouble in the rose-houses in Rochester, N. Y. Mr. W. J. Palmer states that the beetle is found in the morning sitting at the base of the leaves, and if disturbed, usually escapes by dropping to the ground and hiding.

The white grub, *Lachnosterna fusca* (Frolich), has inflicted much damage on pastures in Lewis county, by eating the roots of the grasses. On one farm, that of Mr. J. L. Seymour, near Lyons Falls Station, it had destroyed thirty acres of pasture, and its operations at the time the report was made, seemed to be spreading to several other farms in the vicinity.

I regret that the very brief time that has elapsed between the printing of my fourth report (issued November twenty-third) and the presentation to your honorable board of the present one, has not permitted the more careful preparation and arrangement of the following pages which they would otherwise have received, and the introduction of some desired original illustration. I would, therefore, beg the indulgence of my fellow entomologists, and of those who may be familiar with most of the figures presented, so long as they will be new and serviceable to many of the agriculturists whom they will reach.

Respectfully submitted.

J. A. LINTNER.

REMEDIES AND PREVENTIVES OF INSECT ATTACKS.

Cutting out the Squash-Vine Borer.

This pernicious insect—the larva of *Melittia cucurbitæ* (Harris)—of the injuries of which complaints are often received, was given an extended notice in the *Second Report on the Insects of New York*, pp. 57–68, and the remedies and preventives pointed out which were thought to be the most serviceable against it. In referring to protection by "cutting out the larvæ," it was stated: "When, however, thousands of the larvæ have to be destroyed in order to insure the crop, the method is quite unsatisfactory. It certainly is not reliable under the great increase of the insect in recent years, as stimulated by the increased cultivation of the Hubbard squash."

Fig. 1.—The Squash-vine borer, Melittia cucurbitæ.

I would now recommend its adoption *in the manner detailed below*, in connection with the means which Mr. Goff, of the New York Agricultural Experiment Station, found so successful, viz., "wetting the stems at a distance of two feet from the base of the plants with water containing Paris green at the rate of half a teaspoonful to a gallon, after every rain, from the middle of July to the first of September;" and as preventive of egg-deposit, placing in each hill four or five corn cobs dipped in coal tar, and redipping them from time to time during July and August.

With these methods faithfully employed, there would seem to be no necessity for failure in maturing a crop of squashes, so far as dependent upon the attack of its greatest enemy.

We give below an extract from a communication to the *Country Gentleman* of August 12, 1886, from Mr. H. C. Schmitz, of Albemarle county, Va., in which his manner of detecting the presence of the "borer," its extraction, and subsequent treatment of the vine, are detailed. The success that attended these measures are a sufficient recommendation for their general adoption.

Walking through the plantation at regular intervals, to operate immediately when action was wanted, I noticed the following signs as a certain indication of the presence of the borer.

The vine assumes a more or less yellow color, often the whole, sometimes only the portion near the main root; the leaves droop,

sometimes wilt badly. Generally the borer enters the main stem near the root, but often at the apex of the lower leaves, which then discolor, droop and wilt. If the borer has entered the main stem, now below the surface after repeated workings of the soil, the earth must be scraped away to the depth of two inches, more or less. The main stem on being pressed between the fingers, will be found soft and hollow, often nearly girdled from the inside. Here, with a penknife, I slit the stem, and proceed upward until the inside shows normal growth again. Often I have extracted from such a slit two or three specimens, measuring from one-fourth of an inch or less to one inch or more, some in the main stem, others having proceeded into side branches, even into the peduncles of the leaves. Next working with the knife downward in the direction of the root, you may find more. Let your work be thorough; be not satisfied with finding only one borer; lay bare to your eyes the whole inside of the stem as far as the borer has been feeding. One single borer left will absorb nearly all the sap flowing upward to feed the plant.

The squash vine calloses speedily if some dry dust is rubbed on the wound; then covering the injured stem with a little mound of fine soil, the sap flows again in its natural direction, and the plant recuperates soon. I have plants growing finely now where repeated incisions (the work was not done thorough from the start) had not left more than one-eighth of an inch of bark. If not layered already, layer immediately. The vine strikes root rapidly in mellow moist soil, and as yet I have never found a borer above the layer, nor a second attack in a callosed stem; and it might be a good preventive to slit the stem of the young plant from the root to the third leaf, sprinkle with mellow soil, and layer at the fourth leaf. Then again, I saw to-day some layered plants growing thriftily, where by repeated incisions and workings the main stem had been severed from the main root.

CHANGE OF SOIL FOR STRAWBERRY PLANTS.

At a meeting of the American Horticultural Society, Mr. Smith, of Wisconsin, stated that insects had been a great hinderance to him in raising strawberries, until he practiced setting the plants in soil that had not grown strawberries in several years, kept them well cultivated, raised one crop, and immediately plowed the vines under as soon as the crop was gathered, when he had no more trouble with insects. (*Country Gentleman*, Oct. 7, 1886, p. 753.)

BRINE FOR THE CURRANT-WORM.

I am indebted to Mrs. Lucy T. Chrisman, of Chrisman, Va., for the communication of the following method of protection from the currant-worm, *Nematus ventricosus* Klug.

"I have for three seasons gotten the better of the currant and gooseberry-worm by sprinkling the bush thoroughly, so as to wet each worm and the eggs under the leaves, with brine. It requires a pretty

strong brine to kill the worms — so strong as to kill the bush also unless it be washed off at once by a good wetting with pure water, when no harm is done to the foliage.

This method, if effectual, would be desirable for use against the second brood of worms that makes its appearance in July, if there is fear that the fruit might be dangerous for use from the application of hellebore.

SALTPETRE NOT A PREVENTIVE OF CABBAGE-FLY ATTACK.

In the *Second Report on the Insects of New York*, 1885, page 28, in consideration of statements quoted from agricultural journals of the complete efficacy of a solution of saltpetre in protecting from cut-worms and insects attacking squash and cucumber vines, it was recommended that experiments with this solution be made upon our smaller root insects, such as the radish, cabbage and onion maggots.

At my request, Mr. E. S. Goff, of the N. Y. Agricultural Experiment Station, has kindly made experiments with it upon the most injurious of the above insects, viz., the cabbage-maggot, with the following results:

I dissolved one pound of saltpetre in two gallons of water and poured about a gill of the solution around each plant, leaving alternate rows untreated. This was done on the first indication that the plants were infested, which was on May thirty-first. The application was repeated on June fourth, tenth and sixteenth. On June eighteenth, twenty-nine of the treated plants and twenty-six of those not treated were examined. On the former 124 maggots were found, and on the latter twenty-five. The treated row was the outside of the plat, which may account for its having been infested more than the others. I have frequently noticed that outside rows are more injured by injurious insects than the others. The experiment proved conclusively that nitrate of potash used in the strength and manner described, is not destructive of the maggot, as I repeatedly found the young, apparently just hatched, on the treated plants, as well as of all other stages of development.

In order to see if a stronger solution would avail, solutions of varying degrees of strength were tried, up to saturation, but the larvæ were able to endure the strongest.

We also tried the effect of mixing air-slacked lime with the soil at the time of setting the plants, but with no better success.

In view of the above experiments, it is not probable that the value of the saltpetre solution as a preventive of cut-worm injury, would be sustained by experiments as carefully conducted as were those of Mr. Goff. Its insecticidal properties, if it possesses any, have evidently been overstated.

PREVENTIVES OF CABBAGE-FLY ATTACK.

The "cabbage-maggot"—the larva of the cabbage-fly, *Anthomyia brassicæ*, has proved a difficult insect to control. Various remedies and preventives have been given and suggested, none of which have been found to serve the desired purpose of affording entire immunity from its injuries in all localities. As the injury done to the plant is beneath the surface of the ground, it is evident that the efficacy of the proposed remedy may be materially affected by the character and condition of the soil in which it is employed. Several of the methods that have been found successful in preventing or lessening the losses from this great pest, or that promise success, will therefore be mentioned.

1. Tobacco dust, to be procured from tobacco factories, sprinkled freely over the young plants, is said to prevent the deposit of the eggs by the fly.

2. Mr. Peter Henderson claims that he has been able to prevent the ravages in his sample grounds where all the varieties of cabbages and cauliflowers are tested, by preparing the ground with a dressing of 150 bushels of oyster-shell lime to the acre. In one year when this had been neglected, and a formidable attack was made upon the plants about the middle of May, it was at once arrested, by scraping the soil from the stem of each plant, dusting lime around it and drawing up the ground again to the stem. In addition a handful of guano was dusted around every five or six plants. Strong roots were made above the wounds from the maggots, and the crop was saved. The lime preventive was the result of fifteen years employment in successful cabbage culture. Where the oyster-shell lime is not attainable, its equivalent in stone-lime may be quite as efficient. (*Rural New Yorker*, June 27, 1886, p. 433.)

3. When gas-lime can be obtained as a refuse from gas-works, if worked into the ground at a moderate depth after its exposure for a proper time, it will effectually prevent the operations of the maggot.

4. Ammoniacal liquor, another refuse from gas manufacture—diluted with twice its volume of water and poured around the infested plants in sufficient quantity to reach the roots, will kill the attacking larvæ. It will be a fine fertilizer, also.

5. A contributor to the *New England Homestead* has given this remedy: "Take green burdock leaves and stalks, run them through a hay-cutter, put them in a kettle or tub, and mash them with an old ax or mall, adding water and pounding them to a pulp. Let it stand over night. Have the decoction strong, and when you see the first sign of

the maggot, use it, and you will find it a dead shot for the maggot. Apply it with a sprinkler, taking off the nose, and pour the solution along the rows. I seldom have to apply it a second time." The same remedy is recommended for the onion-worm, and it has, to my certain knowledge, been proved effectual against the attack of the white-grub on strawberry plants.

6. A strong decoction of common tansy, where it is abundant, would probably be about as serviceable as the burdock.

7. A preventive of attack that has been used in England with good result, is, dipping the plants in a puddle of cow-dung or night soil, so as to smear the roots and stems well up to the leaves with the mixture.

8. Another English preventive is to dip the stems in thick soot and water. It appears to impart a bitterness to the plants that the maggots do not relish, and it is also found to ward off attack from grubs and cut-worms.

9. Hellebore gives promise of being as useful against the cabbage (and onion and radish) maggot, as it has proved in protecting tobacco plants from cut-worms. In the latter case, the young plants were dipped before setting out, in a solution of white hellebore in water—one-fourth of a pound in ten quarts of water. A gentleman in West Meriden, Conn., on June twenty-second, set 3,000 tobacco plants, and on the following morning he took from a row of 180 plants 214 cut-worms. On June twenty-fourth, he set out over 2,000 plants treated with the hellebore as above, of which he subsequently found but one plant eaten and that but slightly.

10. Avoid the use of fresh barnyard manure on cabbage ground, as that is believed to invite deposit of the eggs of the fly and to offer protection to the maggot.

Other remedies and preventives are mentioned in the *First Report on the Insects of New York*, 1882 (p. 190), in which an extended notice of the insect is given.

Beans for Repelling the Striped Cucumber Beetle.

The recommendation has often been made of planting beans in each hill with the cucumber seed, to repel the striped beetle. A writer in the *New York Tribune* has given his method of growing beans and cucumbers on the same ground, at first solely with the object of economizing space and labor by getting two crops from the same ground, but which gave the additional result of freedom from the beetle attack. The ground was marked three feet apart each way with a corn plow, and butter beans and cucumbers or melons were

planted alternately in one row, and in the next all beans, thus making the melons six feet apart each way. The string beans were out of the way in time for the melons to occupy the ground. Previous to adopting this method, it had been found necessary to go the rounds every morning before sunrise and kill the beetles, and even then they could not be kept under control.

Gas-lime for the Woolly-aphis.

It appears from Bulletin No. 55 of the University Experiment Station at San Francisco, Cal., that the experiments made with gas-lime for destroying the woolly-aphis of the apple tree, *Schizoneura lanigera* (Hausm.), the root form of which is represented in Fig. 2, have shown the value of this insecticide for the destruction of a pest, hitherto almost beyond our control. In the experiments made about four years ago, an application of ten pounds of the lime to a tree had killed the aphis infesting the roots, but at the same time, some of the trees standing on shallow soil had been killed by the application, and the general results were therefore reported as not satisfactory, the more so, as the aphis was subsequently seen descending to the roots. Since that time it has been found that only the badly located or weak trees had been killed, and that the aphis had not reinfested the roots, but existed only at the surface of the ground. Later experiments with the gas-lime differently applied, gave very satisfactory results, in entirely arresting the aphis attack, without injury to the trees. Instead of removing the soil and putting the gas-lime in close contact with the tree, as done the first time to the corrosion of the bark, about a shovelful and a half (two or three pounds) in a dry state were distributed over the surface in a radius of four feet, trusting to the rain to carry it into the soil. A few shovelfuls of fresh ashes were piled close about the trunk to prevent the aphis from congregating on the crown.

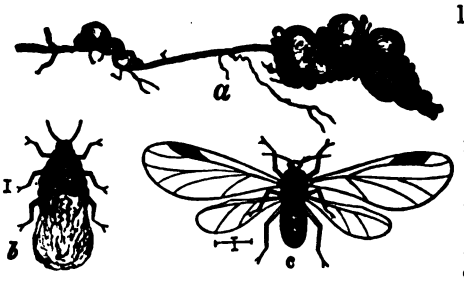

Fig. 2. — The apple-root plant-louse, Schizoneura lanigera; *a*, the knotted root; *b* and *c*, wingless and winged larval forms.

How to Kill the Apple-tree Aphis.

A correspondent had asked for an effectual cure for green lice or aphides on the leaves of apple-trees. He had used kerosene, tobacco and strong soap-wash, each of which had killed the lice, but others appeared very soon in apparently greater numbers than at first.

Answer was returned that it was not difficult to kill the apple-tree aphis, *Aphis mali* Fabr., shown in Fig. 3, and to arrest the attack, if the means be used at the proper time, with proper apparatus, and in the right manner, as herewith given:

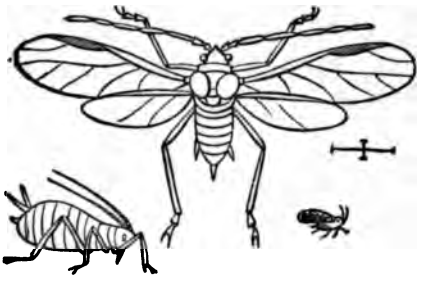

FIG. 3.—Apple-tree aphis, APHIS MALI; winged and wingless forms.

1. *The proper time* to attack the aphis is early in the spring, before the trees are in leaf. Later, many of the insects will be so protected in the folds and curls of the leaves that the applications can not reach them, and contact with the insecticides is essential to their destruction, since they can not be killed by poisoning the foliage of the tree, as their food consists only of its sap. The best time to reach the pest is during the late autumn or winter, when, if the leafless trees be thoroughly sprayed with a kerosene emulsion, the eggs will be killed. The emulsion may be made by violently agitating (through the use of a force-pump or otherwise) until in a homogeneous mass, two gallons of kerosene to one gallon of a hot soap solution, made by dissolving half a pound of common soap in one gallon of water. For use, dilute with nine parts of water — a quart of the emulsion to nine quarts of water, or in the same proportion.

The best time to kill the aphis, if it has been neglected in the egg stage, is just after its hatching, while still gathered upon the unopened buds and portions of twigs adjoining. Without the work of preparing the kerosene emulsion, which involves considerable labor, most if not all may be killed at this time by spraying with strong soap-suds or a tobacco solution, say half a pound of tobacco to a gallon of boiling water. As these solutions often fail to kill the old matured aphis, and as it matures in about ten or twelve days after hatching, a second spraying, and a third if found to be necessary, should follow at about a week's interval.

2. *The proper apparatus* to be used is a force-pump of sufficient power (no farmer or fruit-grower can afford to be without this implement), and a nozzle which will distribute the liquid in a fine spray or mist. There are a number of nozzles which will accomplish this which have been made for use in large orchards. Among these, the most popular ones are the Nixon Climax nozzles, made by the Nixon Nozzle Company, at Dayton, Ohio; the Boss nozzle, and the Graduating Spray nozzle. The Hallowell Brass Company, of Lowell, Mass., have recently put upon the market an atomizer and a nozzle which promises very efficient

work. Suitable pumps may be had of the Field Force Pump Company, of Lockport, N. Y.; Goulds Manufacturing Company, at Seneca Falls, N. Y.; Rumsey & Company, also of Seneca Falls, and P. C. Lewis, of Catskill, N. Y. Each of the above firms will readily send illustrated circulars giving style and prices of their pumps and spraying apparatus from which selection may be made.

3. *The right manner* of applying the insecticide, when employed against plant-lice, is, that it shall be made to reach every insect. This is not essential when the canker-worm and other caterpillars which feed by means of cutting jaws upon the poisoned foliage are to be killed. The finer the spray can be delivered from the nozzle, the more effective is it against the aphis. Other advantages of fine spraying are, economy in the material used, and, in the case of arsenites, less danger of poisoning stock that may enter the orchard before heavy rains have occurred, by the dripping of the liquid from the trees upon the grass. If London purple be used instead of Paris green (with which it is equally effective) of a dilution of one pound to 150 gallons of water, and the spraying be discontinued as soon as the trees commence to drip, danger in this direction will be very little, if any.

TOBACCO DUST FOR APHIS ATTACK.

Mr. Peter Henderson, the experienced and well-known horticulturist of Jersey City Heights, N. J., has lately published his method of dealing with the plant-lice or Aphides that are so injurious to roses, grapevines, chrysanthemums, and hundreds of other species of plants cultivated both in the open air and under glass. While the antidote used by him is not new, his method of application may not be generally known. It is as follows:

"A certain remedy is to apply tobacco dust with a bellows when the leaves are wet, at least once a week — twice is better. We have used this as a preventive remedy for many years with the most excellent results on all plants subject to aphis.

"The main reason why remedies fail is owing to the fact that they are rarely long enough persisted in. One or two applications may check the trouble, but will check it only. My rule for these pests is prevention, which need never fail, if the remedy is steadily applied.

"In our new practice every kind of plant that we know to be liable to be attacked by aphis is dusted over with tobacco dust twice each week from June to October. Of course at such times as the roses or chrysanthemums are in flower, or when the fruit of grapes is ripening, it must not be used, but these conditions only occur for a short season, and there is no necessity for using the dust in winter, as then

fumigation with tobacco stems kills the aphis." (*Popular Gardening*, for December, 1887, iii, p. 50.)

We have omitted from the above the references to prevention of mildew, by mixing one part of black or virgin sulphur to nine parts of the tobacco dust.

A Lime Wash for Bark-lice.

The following application has been recommended for the destruction and removal of scale insects infesting fruit trees. The materials named are certainly sufficiently powerful to accomplish the purpose, and the omission of one or two of the number would not, it would seem, impair the efficacy of the wash. It is as follows:

Slake stone lime, as for whitewash, and to two-thirds of a bucketful add one pint of gas-tar, one pound of whale-oil soap dissolved in hot water, one pound of common soft soap, one pound of potash or one pint of strong lye from wood ashes, and also clay or loam enough to make the wash of proper thickness to be applied with a whitewash brush.

It is also claimed for the above that it is an effectual remedy and preventive of the peach-tree borer, if the earth be removed from the collar of the tree and thoroughly applied about the base; also, that if the trunks of apple trees are coated with it, it will prevent the operation of the striped apple-tree borer.

INJURIOUS HYMENOPTERA.

Nematus Erichsonii Hartig.

The Larch Saw-fly.

(Ord. HYMENOPTERA : Fam. TENTHREDINIDÆ.)

HARTIG: Die Familien der Blattwespen und Holzwespen, 1837, p. 187, No. 9 (original descr.); in Stett. Ent. Zeit., i, 1840, p. 22.

RATZEBURG: Forstinsekten, iii, 1844, p. 121, pl. 3, f. 4.

HAGEN: in Canad. Entomol., xiii, 1881, p. 37 (identified in U. S.); in Rept. Comm. Agricul. for 1883, p. 141–2.

PACKARD: in Rept. Comm. Agricul. for 1883, p. 138, pl. 3, f. 1, pl. 13, figs. 1–4 (history, habits, descr.); Bull. No. 3, Div. Entomol.—U S. Dept. Agricul., 1883, p. 29 (in Maine); in Rept. Comm. Agricul. for 1884, p. 377 (operations); in Amer. Nat., xviii, 1884, pp. 293–296, figs.; in Rept. Comm. Agricul. for 1885, p. 321 (operations); in Bull. 13, Div. Ent.—U. S. Dept. Agricul., 1887, p. 20; Entomology for Beginners, 1888, p. 166, f. 207.

FLETCHER: in Canad. Entomol., 1884, p. 215 (distribution in Canada; in Rept. Min. Agricul. for 1884, p. 215 (distrib.); in 15th Rept. Ent. Soc. Ont., 1885, p. 22 (ravages of), pp. 72–77; Rept. Entomol. for 1885, p. 28; id. for 1887, p. 35.

FYLES: in 14th Rept. Ent. Soc. Ont., 1884, p. 17 (in Canada); in Canad. Entomol., xv, 1884, p. 216.

PROVANCHER: Addit. Faun. Hymenop. Can., 1885, p. 5, f. 1; in Nat. Canad., xv, 1885, pp. 45–53, figs. 8–11 (general notice).

HARRINGTON: in Canad. Entomol., xxiii, 1886, p. 39.

LINTNER: in Entomolog. Amer., iii, 1887, p. 121 (in N. Y.); 4th Rept. Ins. N. Y., 1888, p. 16; in 18th Rept. Ent. Soc. Ont., 1888, p. 32.

JACK: in 17th Rept. Ent. Soc. Ont., 1887, p. 16.

CRESSON: Synop. Hymenop. N. Amer., 1887, p. 158.

SAUNDERS: in 18th Rept. Ent. Soc. Ont., 1888, p. 31 (in Nova Scotia and New Brunswick).

The larch saw-fly is a recently introduced pest, having been brought from Europe, it is believed, into Massachusetts not long prior to the year 1880 on some European larches. It has displayed a disposition for rapid distribution, as it has within the decade spread and carried its ravages over a large part of New England, Canada, and the State of New York. It will in the near future probably extend its range over all that portion of the country where its food-plant, the larch, occurs. Originally feeding in Germany on the *Larix*

Europœa, it seems to have found our native species, *Larix Americana*, commonly known as the tamarack or hackmatack, particularly adapted to its tastes, as shown in the havoc which it inflicts in the tamarack swamps of New York and New England.

The insect is illustrated in Fig. 4. For details of life-history, and its description, reference may be made to the writings of Dr. Packard in the reports of the Commissioner of Agriculture, above cited. For

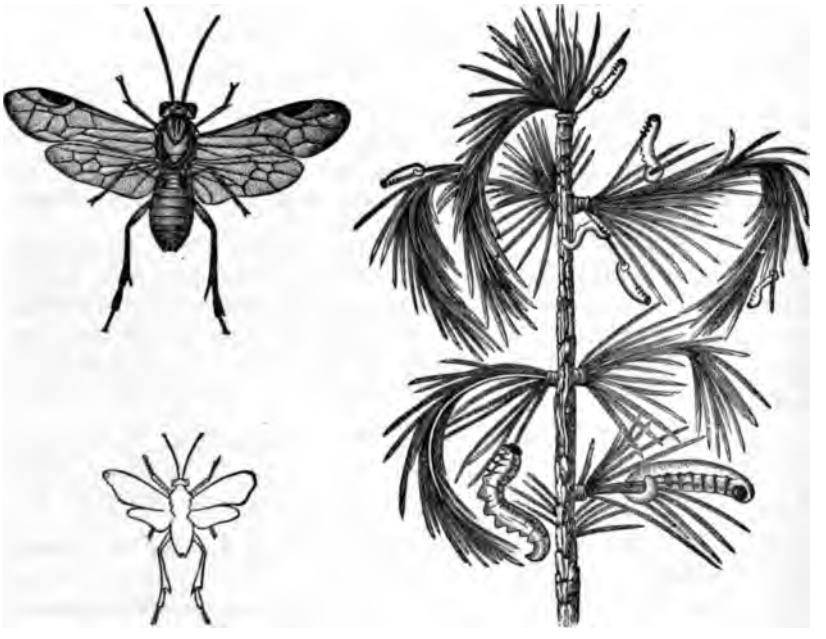

Fig. 4.—The larch saw-fly, Nematus Erichsonii, in natural size and enlarged, and the larch worm of different ages, in natural size. (From Packard.)

the present it will suffice to say that the parent saw-fly emerging from her cocoon in the month of May, probably not long thereafter resorts to the larches and inserts its oval, cylindrical eggs, according to Dr. Packard, in two rows of incisions in the terminal shoot or one of the side shoots, causing a twisting and deformity therein from the presence and growth of the eggs. The larvæ, hatching in June, mature rapidly, "in from five to seven days, or not more than ten," when they descend from the trees and inclose themselves within their elongate oval cocoons beneath moss or other convenient shelter. This occurs the last of June or in early July, in New York. They remain unchanged within the cocoon during the winter and assume the pupal form the following spring, as is the habit of many of the *Tenthredinidæ*.

The Insect in Europe.

Ratzeburg, in his celebrated work on Forest Insects, notices the occurrence of this insect in Germany and in other parts of Europe. It had appeared on the larch in the Hartz mountains and in the plains of Holstein, in sufficient numbers to attract the attention of forestry officers, and it was feared that it might become injurious. According to Dr. Hagen, it had only been observed as obnoxious to the larch twice before 1840, and was very rare in Europe. It was not among the extensive collections of European insects brought thence by him to the Cambridge Museum.

Its Appearance in the United States.

In the year 1880, Professor C. S. Sargent, Director of the Arnold Arboretum at Brookline, Mass., discovered larvæ feeding upon some European larches, *Larix Europœa* growing in the vicinity. They were submitted to Dr. Hagen, of the Museum of Comparative Zoölogy at Cambridge, and identified by him, from the description and figures of Ratzeburg, as *Nematus Erichsonii* Hartig. This is the first record of the appearance of this saw-fly in this country, which soon thereafter developed destructive powers entirely foreign to its European character.

Its Spread throughout New England.

It is reported as having been injurious to larches in the State of Maine, in 1881, and in 1882 its operations were observed by Dr. Packard, during the month of August, in the vicinity of Brunswick, Me., as detailed in his "First Report on the Destruction of Evergreen Forests in Northern New England," *loc. cit.* The same year, it also appeared in New Hampshire.

Its Occurrence in New York.

The following year (1883) about July twenty-fifth and early in August the effects of the insect were observed at Horicon and Pottersville, Warren county, and at Schroon lake in Essex county. By the first of August the trees had been defoliated. The region affected was very extensive, covering many square miles in different swamps. It was also reported "from Schroon lake to North Elba and about Mount Marcy." (Packard.)

During the years 1884, 1885, and 1886, the same attack upon the larches, or tamaracks, as they are more generally called, was observed by State Botanist Peck, in several of the counties of Northern New York. The notes kindly given me of the place, time and degree of injury wrought, were intrusted to a friend for his use and have been unfortunately lost, so that the details can not now be put on record.

In St. Lawrence county.—June 29, 1887, larvæ of this species were received for name from Dr. E. L. Sturtevant of the State Agricultural Experiment Station, which had been sent to him by Mr. E. Phelps of De Kalb Junction. When the package was opened the following day, one of the larvæ had already inclosed itself in its cocoon. It is believed that this is the earliest recorded date of larval maturity. The following notice taken from the *St. Lawrence Republican* of July 27, 1887, will give some idea of the immense number in which the "worm" made its appearance:

Mr. David Page of Jerusalem Corners, in this town, has given us an account of a remarkable pest of worms which recently infested his premises. There are three larch or tamarack trees growing in his door yard. About July seventh, very soon after the extremely hot weather set in, a few worms appeared upon them, feeding upon the leaves. The next day they had doubled in number, and in a day or two had become a countless host, completely covering the trees, so that the end of the finger could not be placed even on the trunk of one of them without touching one or more of the worms. They also covered apple and maple trees and shrubbery, and the grass beneath, but ate nothing, so far as could be discovered, except the leaves of the tamaracks. They swarmed upon the house and piazza, and it became necessary to sweep them from the latter every few minutes. They accumulated in little windrows along by the house. The countless hordes of worms became an object of great curiosity and interest to people of the neighborhood, and Mr. Page and his family became really alarmed as to the result of this invasion; but in scarcely a week from the time of their first appearance they disappeared as rapidly as they had come, and in a day or two none of them were to be found. The tamaracks were left as bare as in winter, but no other signs of damage were visible. Whether the worms had gone into the ground or what had become of them seems not to have been ascertained.

In Otsego county.—Other examples of the larva and two of the cocoons were received by the State Entomologist, July ninth, from Rev. Henry U. Swinnerton, of Cherry Valley. He has kindly furnished, on request, some observations made by him, extracts from which are herewith given, as showing interesting habits of migration, etc. of the larvæ, when occurring on isolated trees. Under date of July ninth, he wrote:

I send you specimens of a worm that has appeared in considerable numbers on a larch tree on the lawn of Mr. Lansing, my neighbor. They began dropping off in a pattering shower, and are migrating towards some maples not far off.

Additional particulars of the migration were furnished under date of July twelfth:

The larch saw-fly worm seems to have disappeared, and within a very limited distance from the tree from which they started. They crept in an easterly direction diagonally toward the street, about

thirty feet from the tree. Several maples in the track were invaded. Salt was strewn on the flagstones to kill them, but many reached the maples outside. I do not find that a single one crossed the road. Where they disappeared to I can not imagine.

I know of but four larches about the village — two of them fine, good-sized trees. Of two smaller ones, one quite small, had some of the worms upon it, and the foliage shows that it had been eaten, but only a little. The other is embowered among maples, and does not seem to show any injury. But the two large trees are very much stripped, only a few of the lower branches retaining any foliage. The second of them is on Miss Roseboom's place. * * * * In this case also, the worms crept in an easterly direction, going up a pine, some hemlocks, and a horse chestnut —"millions of them," as I am told.

I had a man climb both the larch and a maple at Mr Lansing's in search of the saw-flies, but he could find hardly one. We then began to discover apparently dead ones, then a few living ones. But it seemed surprising that so few should be discoverable. Further search revealed more living ones just beneath the ground and among the moss at the roots of the tree, especially under the larch. Finally we were led to conclude that the brown cocoons, of which there seemed to be a great number, must belong to them. I inclose the whole collection in a box and send it to you. * * * * It was only last Thursday (July seventh), that the worm was first observed.

A diagram of a portion of the village accompanied the above communication, showing streets, residences, the location of the trees, direction of the migrations, etc. — evincing the interest excited by the appearance and movements of the new visitor.

In Schoharie county.— The following paragraph from the *Country Gentleman* of July 14, 1887, refers, without doubt, to the operations of the larch saw-fly larva.

The tamarack trees in this section are infested with multitudes of rather small, green worms with black heads, which are stripping them of their foliage.— *Sharon Centre, N. Y.*, July 8, 1887.

Personal Observations in Hamilton County.

During a visit to the southern portion of the Adirondack region, July fourteenth to August fifth, the opportunity was offered of making a few observations on this insect. The season at this time was too far advanced to note the attack either at its commencement or its height. All of the larches within sight of the stage route from Newton's Corners, at the foot of Lake Pleasant, to Sageville at its head, a distance of four miles, had been almost entirely stripped at the earliest date above named. The trees of this species of which there are many, in some places it being the prevailing growth, could be recognized at the greatest distance from which they could be seen by their

nakedness, appearing as if dead, which undoubtedly some of them were, as the result of previous defoliation. The elevation above tide of Lake Pleasant is 1,800 feet.

No information could be obtained of residents of the time when the injury to the larches had first been noticed. To many it seemed quite new when their attention was at this time called to it, although it might probably have been observed during the two or three preceding summers.

Very few of the larvæ were to be found on the trees on the nineteenth July, and as most of these were apparently but about half-grown and of a pale green color, as if recently molted, it is not improbable that they were belated, sickly, or parasitized individuals which were destined not to attain maturity.

Not all of the larches in the vicinity had been wholly stripped. A large one of eighteen inches in diameter at three feet from the ground and reaching upward to a height of at least seventy feet, standing alone in a pasture lot, and throwing out long and thick branches, had its foliage less than one-half eaten. From a large number of larches of a moderate height — of fifteen feet and under — that were entirely free from harm, it appeared that the younger trees were not sought by the parent saw-fly for oviposition. Whenever they had been eaten, they were in the immediate vicinity of larger trees, which, having been stripped, the migrants from them, in their search for food, may have been able to ascend, with difficulty, in small numbers, such of the smaller ones as chanced to be in their way. The tips of these small larches, gave no evidence of oviposition in them.

Cocoons.— Cocoons, in some instances only, were found underneath the trees where search was made for them, but not at all commensurate with the immense number of larvæ that had evidently been present. Is it the habit of the larva to wander from the feeding-ground to some distance in search of a favorable place for pupation? Do they leave the tree for the purpose at about the same time, after the habit of some of the Lepidoptera, as, *Datana ministra* and *Œdemasia concinna;* and if so, is this the explanation of the "migrations" previously mentioned? Most of the cocoons collected were taken from underneath moss growing around the borders and in cavities of rocks. A large proportion — about ten per cent — had been eaten into at one end and the larva consumed.

Parasites and Enemies. — From the number of ants that were noticed in association with the cocoons, it was thought that the credit for this destruction might be due to them. With so active an enemy travers-

ing the soil in every direction, but few of the larvæ could be expected to survive the winter.

A *Podisus* pupa (one of the large plant-bugs) was taken July nineteenth from the trunk of a tree feeding on one of the saw-fly worms. It was subsequently fed in confinement on *Nematus* and *Haltica bimarginata* larvæ to the imago stage, which it assumed July thirtieth, when it proved to be *Podisus modestus* Dallas. In fastening upon its prey, in almost every instance observed its proboscis was inserted near the anal end of the larva. Full-grown forms of both species were fearlessly seized and firmly held by it until their fluids were exhausted. The larvæ collected were remarkably free from parasitic attack. A single small white cocoon, apparently of a *Microgaster*, was obtained from a half-grown example.

Larvæ failed to mature. — Although rather large collections were made of the cocoons (several hundred) at Sageville, not one of them gave the imago the following spring, although they were carefully secluded from light and given a damp atmosphere from water evaporated underneath the breeding-case during most of the autumn and winter. Failing to disclose the imago in due time, a number of the cocoons were opened, when each was found to contain the shriveled remains of the larva — none having reached the pupal stage.

The Hibernated Insect from Cherry Valley, N. Y.

In consideration of the above failure to obtain examples of the perfect insect for the State collection, request was made of the Rev. Mr. Swinnerton, of Cherry Valley, for some hibernated cocoons, if procurable, from underneath the infested larches of last year. A number were received, on May 1, 1888, which, upon opening a few, disclosed the living insect in its pupal stage. On May eighth, four of the saw-flies emerged, and the following day, eighteen others — all of which, except one, were females. No others appearing, the remaining cocoons were opened for examination, and gave a half-dozen dead matured females, and from one within a slight inner cocoon, the pale yellow-green pupa of a large ichneumon fly, believed to be a *Pimpla*, was taken, and cared for, but failed to develop.

That additional males, and knowledge of the relative proportion of the sexes, and perhaps other parasites, might be obtained, request was made of Mr. Swinnerton for another sending of cocoons, if not too late for finding them with living pupæ. The larger number were reported open at one end and empty. Of the few that were received on the eighteenth of May, twenty had given out the insect when

examined on the twenty-third, four on June first, and six others by the eighth of June — the latest date of emergence.

Disparity of sexes.— Of fifty-eight examples of the fly examined, only *one* was of the male sex. Is it possible that the cocoons were not received in season (May first) to secure the males, which ordinarily are the first to make their appearance? Still, in rearing, in July, 1888, from the larvæ collected on or about a poplar (*Populus monilifera*) a number of the poplar saw-fly, *Aulacomerus lutescens* Lintn., a marked disparity in sexes was also observed, although not so great as in the larch saw-fly, above. Of fifty-two examples of this species reared, only six were males. It is easy to carry through to its perfect stage the first brood of this insect, and the conditions, therefore, attending it within doors should so nearly approach those in nature that the results should be almost the same.

Injuries from the Insect.

In August, the larches observed in the Lake Pleasant region which, during the preceding month had been entirely denuded, had commenced to put forth new leaves. This was probably the second year's defoliation of many of the trees. It is doubtful whether they would be able to survive the repetition of the injury for another year. In Maine and Canada, where the insect has prevailed quite generally since 1884, the larches over large areas have been killed, and it is the opinion of foresters that the entire loss of the foliage in early summer, for three consecutive years, proves fatal with very few exceptions.

The addition to our list of insect pests of one which threatens the entire destruction of a tree so valuable as the larch, can not be regarded otherwise than in the light of a serious calamity. It would appear, at the present, that this evil is destined to become more general than the destruction of the spruce (the timber of which is of so great economic importance) in many localities in northern New York, for the latter, as yet, is but a local (?)disease, and may therefore prove, when satisfactorily accounted for, to be the result of purely local causes. There is hardly a doubt but that the range of this new pest will be almost co-extensive with that of the larch, viz., over a large portion of the northern United States and the adjoining British possessions, even into the Arctic region.*

* Northern Newfoundland and Labrador to the eastern shores of Hudson bay, Cape Churchill, and northwest to the southern shores of the Great Bear lake and the valley of the Mackenzie river within the Arctic circle; south through the northern States to northern Pennsylvania, northern Indiana and Illinois, and central Minnesota (Sargent's *Report on the Forests of North America.*)

The wood of the larch is given by Prof. Sargent as "heavy, hard, very strong, durable in contact with the soil; preferred and largely used for the upper knees of vessels, for ship timbers, fence posts, telegraph poles, railway ties, etc." L' Abbé Provancher, in his notice of the larch saw-fly above cited, in which he regards it as threatening the entire disappearance of this precious tree of the Canadian forests, since from the first notice of the insect in America in 1880, it had already in the year 1885 spread with such remarkable rapidity and destructiveness, that "from Halifax to Ottawa, and perhaps even beyond, there is not to be seen in July and August a single larch having its foliage intact"—has written as follows of this tree and its value:

It is known that this tree grows in wet or marshy lands, where the soil ordinarily is of poor quality. Among its roots, which it sends out horizontally at a moderate distance from the surface of the ground, there is always to be found, on one side or the other, one that is much larger than the others. It is often said that this tree has but a single root, the others being only ramifications of it. As this root forms a right angle with the trunk, and as the wood is very strong, very slightly brittle, and almost free from decay, it is the prized source for the elbows and knees that enter into naval constructions. In addition to its being an excellent fuel, this wood is also desirable for a multitude of uses, as for boat-bottoms, joists for buildings, fence posts, etc. The larch forms also a very handsome ornamental tree; its elliptical cones of about an inch in length, of a beautiful purplish-violet shade, and ordinarily a great number on the same tree, give a charming effect, when in June they join themselves to the delicate foliage, simulating fringes or sparkling bouquets of so lively a green that the sun seems powerless to change it. And besides the graceful picture that it presents, the tree perfumes all its surroundings with a resinous odor which is most agreeable.

Remedies.

When the larch occurs as isolated trees or in groups of moderate extent, it is an easy task to save its foliage from destruction by the saw-fly larva. The attack of its hosts is quickly noticeable, and if they are then shaken or beaten from the branches they may be crushed under foot or with a roller. Of those that may escape very few will succeed in ascending the trunk, since, although the Nematus larva is bountifully provided with legs, having twenty, while most of the caterpillars of butterflies and moths have but sixteen, yet these organs are not developed to the extent of making them suitable for easy climbing. Or, the worms may be killed by spraying the foliage with Paris green or London purple in water, according to directions so often given.

When large areas of the larch are infested, as tamarack swamps, it will be useless to attempt to compete with the enemy. Its destruction through any applications that might be made would be altogether too costly to warrant the outlay required. The best that could be done in such cases would be to fell the trees as soon as it is noticed that they are dead or doomed, and before decay has impaired their value, and use them for some of the many purposes for which the timber is available.

Nematus salicis-pomum Walsh.

The Willow-apple Gall Saw-fly.

(Ord. Hymenoptera : Fam. Tenthredinidæ.)

Walsh: in Proc. Ent. Soc. Phil., vi, 1866, pp. 255–256 (description of gall, larva, imago, etc.).

Norton: in Trans. Amer. Ent. Soc., i, 1867, p. 216–218 (description of larva and imago).

Walsh-Riley: in Amer. Entomol., ii, 1869, pp. 45–49, f. 30 (general account).

Cresson: Synop. Hymenop. Amer., 1887, p. 159 (cited).

The galls of this tenthredinid were observed June twenty-seventh, at West Albany, N. Y., on willow, *Salix cordata*. Several of them had been eaten into, making an irregular funnel-like cavity. One that was opened for examination had the interior wholly consumed and contained, instead of the Nematus larvæ, four small white, legless grubs, which were probably those of a "guest-beetle," named by Mr. Walsh, from its appropriating the gall of another insect, *Anthonomus sycophanta;* another, which had been but partly eaten, contained one of these larvæ. The eaten galls were more rosy-cheeked than the others. None of the larvæ were carried to maturity, their failure to mature being, doubtless, the result of the galls having been collected so early.

An extended account of this willow-apple gall (with illustration), and of the three guest-insects that usurp its shelter and its food, is to be found in the *American Entomologist* (loc. cit. sup.). In it, Mr. Walsh states that the eggs of *N. salicis-pomum* are deposited in a slit of the willow leaf toward the end of April. The larva attains maturity during the last of July ; it pupates within the gall, where it, hibernates, and the winged insect emerges in April — from the sixteenth to the twenty-fifth, as in large numbers, reared.

INJURIOUS LEPIDOPTERA, ETC.

Darapsa Myron (Cramer).

The Green Grapevine Sphinx.

(Ord. LEPIDOPTERA: Fam. SPHINGIDÆ.)

Sphinx Myron CRAMER: Pap. Exot., iii, 1782, pl. 247, f. C.
Sphinx pampinatrix SM.-ABB.: Lep. Ins. Geo., i, 1797, p. 55, pl. 28.
Otus Myron HÜBNER: Verz. Schmett., 1816, p. 142, No. 1524.
Otus Cnotus HÜBN.: Zutr. 3d Hund., 1823, p. 23, figs. 321, 322.
? *Smerinthus Myron:* ST. FARG.-SERV.: in Encyc. Method., x, 1823, p. 441.
Everyx Myron BOISDUVAL: in Sp. Gen. Heteroc., i, 1836, p. 209.
Chærocampa pampinatrix HARRIS: in Sill. Journ., xxxvi, 1839, p. 301.
Darapsa Myron WALKER: List Lep. Br. Mus., Pt. viii, 1856, p. 183.
Ampelophaga Myron GROTE: in Canad. Entomol., xviii, 1886, p. 132.

Above are given the various names under which this common and injurious insect appears in our literature.* Of these, the name bestowed upon it by Dr. Harris was expressive of the appearance and habits of the caterpillar *chærocampa*, meaning, in the Greek, "the hog caterpillar," and suggested by the fancied resemblance of its front segments to the head and snout of a hog (see Fig. 5), and *pampinatrix* signifying, in the Latin, "a vine-pruner." Scientific names should, whenever possible, indicate some feature, character, habit, or peculiarity of the object or creature to which they are applied, and it is, therefore, to be regretted that the one selected by Dr. Harris for this insect could not have been retained, but in obedience to the law of priority, the specific name given to it by Cramer fifty years before must be substituted for it, although a mere chance-chosen proper name. The six different genera to which it has been referred since Cramer's time illustrates the lamentable want of fixity in generic appellations — an evil which we will have to endure so long as there are those among us who are seemingly goaded by an irresistible impulse to cut to pieces the old genera, and to endeavor to give vitality to new. It is a sore evil, fettering science, and tending to impede its progress instead of aiding in its advance. Favored above

* Other bibliography of the species is omitted in consideration of its extent.

many is he, who, as he scans these long lists of uncalled-for, short-lived, often still-born genera, can exultingly say: "I thank God that I baptized none of you!"

A Common Insect.

Darapsa Myron (as we prefer to call it for the present) has a distribution over a large portion of the United States, being found in all the region east of the Mississippi river, in some of the States west thereof, and in Canada. The caterpillar occurs oftener on the grape than any other of the Sphinges having the same food-plant, viz., *Thyreus Abbotii* Swainson, *Deilephila lineata* (Fabr.), *D. chamœnerii* Harris, *Philampelus Pandorus* (Hübner), and *P. achemon* (Drury). It is made the more conspicuous by the parasitization to which it is peculiarly liable, and when in this condition its larval existence is considerably prolonged — not maturing and pupating as it otherwise would.* For these reasons it frequently comes under the observation of the grape-grower, exciting his curiosity, and causing it to be sent to the entomologist for information regarding it. The following notice will meet some of these inquiries.

The insect may be readily identified from the description and figures herewith presented.

Description of the Caterpillar.

Young Larva.— After its first molting it measures one-half inch in length. It is of a light green color, with the usual oblique lateral bands of the Sphingidæ running into a yellow subdorsal line. Along the body dorsally is a series of triangular yellow spots, which, on the sixth and seventh segments, are centered with orange. The caudal horn is green, straight, and two-tenths of an inch long ; it continues to be straight through following moltings until after the last — the fourth molt, when it assumes the usual curved form.

Mature Larva.— The head is small, oval, pale green, with numerous yellow granules and four yellow perpendicular lines. The body is swollen on the third and fourth segments, tapering rapidly thence to the head. Its color is yellowish-green, speckled with numerous pale yellow dots. The seven oblique lateral bands cross the

* "It is one of those remarkable and not easily explained facts which often confront the student of Nature, that, while one of these hog-caterpillars in its normal and healthy condition may be starved to death in two or three days, another, that is writhing with its body full of parasites, will live without food for as many weeks. Indeed, I have known one to rest three weeks without food in a semi-paralyzed condition, and, after the parasitic flies had all escaped from their cocoons, it would raise itself and make a desperate effort to regain its strength by nibbling at a leaf which was offered to it." (Riley.)

spiracles and connect above with a white stripe which borders a dark green subdorsal line extending from the lateral stripes of the head nearly horizontally to the tenth segment where it curves upward to the caudal horn; on the three anterior segments the subdorsal line is bordered beneath with yellow. Usually on the back are five or six pale green or yellow spots of which the base of each rests on the anterior portion of the segment, and the apex on the posterior, having within them a lozenge-shaped dull rose-red spot resting on the anterior margin. The spiracles are orange colored, with a white spot at each end. The caudal horn is curved, one-fourth of an inch long, bluish-green, granulated in black in front and in yellow behind, and with a yellow tip. Length of caterpillar, two inches.

FIG. 5.— The grapevine hog-caterpillar, DARAPSA MYRON.

A short time before its pupation, the color changes to a dull rose throughout, with the white lateral and the subdorsal bordering bands of a clearer rose. Previous to this change of color, I have observed the caterpillar to pass with its mouth over the entire surface of its body and of its horn even to the tip, applying to it a coating of what seemed a glutinous matter — the operation consuming about two hours. *

Its Injuries.

Although often a serious annoyance in vineyards, it does not in its general behavior merit the bad reputation given to it by Dr. Harris. He says of it: "Not content with eating the leaves only, it stops at every cluster of fruit and, either from stupidity or disappointment, nips off the stalks of the half-grown grapes and allows them to fall to the ground untasted. I have gathered under a single vine above a quart of unripe grapes thus detached during one night by these caterpillars."

* *Proceedings of the Entomological Society of Philadelphia*, iii, 1864, p. 663.

Usually Destroyed by a Parasite.

No effectual method is known by which to protect the grapevine from these caterpillars, and resort must therefore usually be had to hand-picking. But in collecting and destroying them care should be taken to save from destruction those which have attached to their body a large number of small oval white objects resembling eggs (see Fig. 6) and generally mistaken for them. They are not eggs but the pupal-cases of the parasite — the natural enemy of this caterpillar. So faithful is it to its mission that very few of the caterpillars escape its persistent search and reach maturity. Perhaps nine out of ten are destroyed by it. The parasite is a small four-winged fly, belonging to the parasitic family of *Braconidæ*, and is probably *Apanteles congregatus* (Say).* Having discovered one of the caterpillars, it pierces its body in numerous places, depositing an egg in each wound. These in due time hatch out into grubs within the caterpillar, where they feed upon its interior, instinctively avoiding the consumption of the vital parts that their food may continue to be suitable for them. Usually after the last molting of their host, while to all outward appearance it is uninjured and thriving, although careful observation may have shown it to have refrained from feeding for several days, all at once a host of little heads may be seen eating their way through the skin of its back and sides. Within an hour's time the entire brood of grubs — a hundred or more it may be in number, have wriggled outwardly, and with their terminal segment fastened to the body by a few silken threads spun for the purpose, commence building about them their small firm, egg-like, snow-white cocoons, which, securely attached and standing on end are usually so numerous as to cover all of the upper part of the body and the sides of their victim. In two or three hours, they are all inclosed.† In about a week, the grubs have completed their rapid transformations, when a neatly fitted lid is pushed open at the top of each little cocoon, pressed to one side, and the

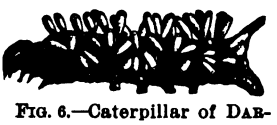

Fig. 6.—Caterpillar of Darapsa Myron bearing the cocoons of the Microgaster parasite.

*I have had the same parasite from larvæ of *Thyreus Abbotii*, *Philampelus Pandorus*, and *Sphinx kalmiæ* — the last not a grapevine feeder.

†For an interesting account and graphic illustration of the peculiar manner in which these Microgaster cocoons are spun on the body of Philampelus (and probably on D. Myron also), see an article in the *American Naturalist* for 1878, vol. xii, pp. 558-560, by Mr. J. P. Marshall.

perfected parasite escapes. I have had them emerge as early as the twenty-fourth of August. The victimized caterpillar, now in a flaccid, shriveled condition, lives for a few days, without food or motion, and dies.

Insect Friends and Foes.

The above history should furnish an argument in favor of such a diffusion of entomological knowledge as may enable the agriculturist, fruit-grower and florist, to discriminate between his insect friends and foes. If, from ignorance, one should crush under foot one of these parasitized creatures believing it to be a ravenous caterpillar bearing hundreds of its eggs(!) upon its back, thinking thereby to check its increase (and this procedure we fear is the rule that prevails), he has taken the best possible means of promoting its multiplication by destroying the natural enemy whose special mission it is to prey upon it.

Pupation.

The larvæ that are so fortunate as to escape parasitic attack spin closely together a few leaves on the surface of the ground, within which they change to pupæ in three or four days.

The pupa is from one inch to an inch and two-tenths long and about one-third of an inch broad. It is without the projecting tongue-case of many of the sphinges. Its pale brown color is a distinguishing feature. The head-case is rounded, depressed, black-dotted and with a black crescent over the eye. The wing-cases are lighter brown, with numerous roundish, black, irregularly spaced spots on the nervures and a cluster near the base. The leg-cases and tongue-case are also irregularly dotted with similar spots, while the antennæ-cases are without them. The segments are dark brown at the incisures and are covered with numerous small indentations, of which some are black — those of the last two segments more conspicuous. The first spiracle has a black spot posterior to it, while the others are surrounded by black. The terminal spine is one-tenth of an inch long, curved, smooth, shining black, and minutely bifid.

The Moth.

The moth appears abroad from the middle of June to August. Mr. Saunders, in his "Insects Injurious to Fruits," represents it as double-brooded, but it is doubtful if it is so at the north. For some reason the imago develops very unequally, for, from larvæ collected at the same time and with their pupation under identical

conditions, I have noted a difference of between three and four months in the time of the emergence of the moths — in one instance 104 days. But not infrequently, as occasionally in *Macrosila quinquemaculata* and other one-brooded *Sphingidæ*, some of the earliest larvæ complete their transformations during the same summer, and appear abroad on the wing, but at too late a season for a second brood of larvæ to mature and attain pupation. Thus Dr. Harris reports (*Entomological Correspondence*, page 283), that two matured larvæ taken by him on July thirty-first, entered the earth on August third, pupated on August sixth and seventh, and gave out the imago on August twenty-ninth.

Fig. 7.—The green grapevine moth, Darapsa Myron.

The moth is so well pictured in the figure that it need only be added that the head and thorax are olive-green; the abdomen of a dull green, shaded with reddish; the front-wings greenish-gray, banded and shaded with olive-green; the hind-wings rust-colored, with some green at the internal angle.

Remedy.

The caterpillars of this species have never proved so abundant but that their depredations could be controlled by picking them from the leaves upon which they are feeding and crushing them under foot. In addition to the grapevine, it feeds also on the Virginia creeper, *Ampelopsis quinquefolia*.

Alypia octomaculata and Eudryas grata.

The Eight-spotted Forester and *the Beautiful Woodnymph.*

(Ord. Lepidoptera: Fam. ?Zygænidæ.)

Sesia 8 maculata Fabricius: Spec. Ins., ii, 1781, p. 155, No. 8; Ent. Syst., iii, pt. i, 1793, p. 381, No. 8.*

Zygæna 8 maculata Fabricius: Mant. Ins., ii, 1787, p. 106, No. 51.

Sphinx octomaculata Smith-Abbot: Lep. Ins. Geo., i, 1797, p. 87, pl. 44.

Agarista octomaculata Latreille: Encyc. Method., ix, 1819, p. 803, No. 3.— Boisduval: Ann. Soc. Ent. Belg., xii, 1869, p. 68.— Melsheimer: in Harr. Entomolog. Corr., 1869, p. 116.

* The locality given by Fabricius for this insect, "India," would seem to be an erroneous one.

Alypia octomaculata HÜBNER: Zutr., 22, 1818, f. 119.—HARRIS: Entomolog. Corr., 1869, p. 285–6 (larva in different stages).—STRETCH: Zyg.-Bomb. N. A., 1873, p. 6, pl. 1, f. 7.—RILEY: 6th Rept. Ins. Mo., 1874, pp. 94–96, f. 25.—SAUNDERS: Ins. Inj. Fruits, 1883, p. 262–3, f. 272.—Et al.

Bombyx grata FABRICIUS: Ent. Syst., iii, Pt. i, 1793, p. 457, No. 158.

Eudryas grata BOISDUVAL: Spec. Gen. Lep., i, 1836, p. 14.—HARRIS: Ins. Inj. Veg., 1862, p. 427, pl. 6, f. 8.—STRETCH: Zyg.-Bomb. N. A., 1873, p. 147, pl. 7, f. 1.—RILEY: 6th Rept. Ins. Mo., 1874, pp. 88–90, figs. 22, 23.—SAUNDERS: Ins. Inj. Fruits, 1883, pp. 258–261, figs. 268–270.—Et al.

The caterpillars of the two species of moths above named occur on the grapevine and Virginia creeper (*Ampelopsis quinquefolia*), and are often referred to, and have been frequently written of, as "the blue caterpillars of the vine." Although they bear so strong a resemblance to one another as not to be distinguished apart by the ordinary observer, and with difficulty by the entomologist,* yet the perfect insects differ almost as widely in their general appearance as it is possible for moths to do. It is often of much importance that the winged form of insects which are injurious in their larval stage should be generally known, in order that, when seen abroad, they may be recognized as the precursors of the injuries which are to follow in their train, and either be captured for destruction or driven away from the plants that they infest, or insecticidal application made that will arrest the career of their young as soon as they emerge from the egg. Such knowledge should be of particular service in preventing the attack of the eight-spotted Forester, which is often disastrous to the grapevine, and most annoying to one who has been watching and admiring the vigorous growth of the graceful Ampelopsis in its upward climb, and finds too late that further progress for the season has been arrested by the unnoticed eating away of almost every one of the most thrifty and tallest tips. Its moth is often to be seen as a conspicuous object from its peculiar coloring, flying at all hours of the day, unlike most of the moths, and hovering with a motion that attracts the eye, over the foliage upon which it alights from time to time to deposit an egg.

The Moths.

The figures given of the two moths will serve for their ready recognition if in connection therewith their marked colors are mentioned. Both pairs of wings and the fringes of *Alypia octomaculata* are

* In writing of *A. octomaculata* larva, Dr. Melsheimer has remarked: "It resembles the larva of *Eudryas grata* in its colorings and markings so much that before I was acquainted with its manners, I have frequently taken the one for the other, and was not aware of confounding them until the moths were disclosed." (*Harris Entomolog. Corr.*, 1869, p. 116.)

velvety-black; on the front pair, between the two spots before and below, and sometimes above the inner one and behind the outer, are lines or spots of violet-colored scales of a rich metallic lustre; the two spots of the front wings are pale yellow, and those of the hind pair, white. The thorax and abdomen are black, the former with a small yellow spot just behind the head, and yellow shoulder-covers shading paler toward their tip; the abdomen is marked with a small yellow tuft medially on its basal segment, and in the male with a few whitish hairs on the middle of each segment and a triangular-shaped white tuft on the segment before the last. The tibiæ (shanks) of the anterior and middle pairs of legs are clothed with long, deep orange-colored hairs. In the male, in front of the anterior legs, are two rather long, yellowish-white tufts.

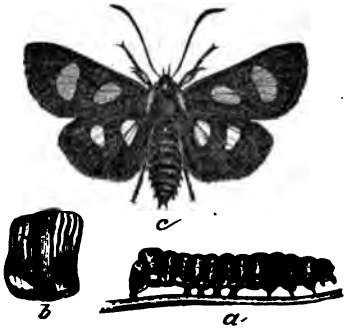

FIG. 8.—The eight-spotted Forester, ALYPIA OCTOMACULATA; *a*, the caterpillar; *b*, an enlarged segment of the same; *c*, the female moth.

In *Eudryas grata*, the anterior wings are pure white within. The stripe extending half-way across their front and the broad band crossing the outer margin are rusty-brown, bordered with olive-green; the band is traversed by waved lines of violet-colored scales of a metallic lustre; on the middle of the inner margin is a large triangular spot of olive-green. The posterior wings are dull yellow, with their hinder margin bordered with brown. The head is black. The thorax is crested with black, interspersed with pearl-colored scales; the shoulder-covers are white. The abdomen is yellow, with a row of black spots centrally and on its sides.

FIG. 9.—The beautiful woodnymph, EUDRYAS GRATA.

The Alypia Caterpillar.

The Alypia caterpillar has frequently proved a serious pest in certain parts of New York city in almost entirely stripping the grapevines of their leaves, and continuing the injury for several years in succession. In some localities—in Albany and elsewhere, it is becoming, or has already become, quite injurious to the *Ampelopsis* in eating off its terminal shoots and thus arresting its extension. It may be readily recognized from the representation given of it in Fig. 8, at *a* and *b*, and the following statement of its principal colorational features. The head is yellowish, with about eight black dots on each side. The

collar on the first segment is pale orange, dotted with black. The second and third segments have a transverse series of black dots, but without an orange band; the other segments have each a broad, central, orange band, with four narrow black bands on each side, counting those that border the orange. From each of the black dots shown in the enlargement, a long white hair is given out, which is longer than represented in the figure. Below the line of the stigmata (breathing-pores) is a series of white spots on segments four to nine, just behind the orange band; a large white spot rests on the incisure of the tenth and eleventh segments. The legs are orange at their base, and black externally and at their tip, except the anal pair, which are orange dotted with black.

The caterpillar may be found upon the Ampelopsis from the first of June until the first of August — its long continuance making it quite difficult to control its operations either by hand-picking or by insecticidal applications.

The Flight of Alypia.

The moth is a day-flier, and has, of late years, become very common in Washington park, Albany, where almost every year it may be seen flitting abundantly about the blossoms of *Deutzia gracilis*, upon which it delights to feed. Not unfrequently from ten to fifteen of the prettily and conspicuously marked creatures may be seen hovering over or momentarily alighting upon a single plant. It flies as early as 9 o'clock in the morning and continues until 6 P. M., or later. Commencing to appear as early as the middle of May, it remains until the middle of June. I have also observed it, in the same locality, flying abundantly, on May twenty-eighth, about the flowers of the bush-honeysuckle, *Diervilla Japonica*.

The Eudryas Caterpillar.

Both the caterpillar and the imago of *Eudryas grata* are rare; the former is so seldom met with that collectors experience difficulty in procuring specimens from which they may rear the beautiful moth for their cabinets. The caterpillar, *a*, in Fig. 10, is characterized by *three* black bands on each side of the central orange band, instead of the *four* in *A. octomaculata;* an absence of the lateral series of white spots, and the presence of a prominent hump on the eleventh segment. Other features of it are shown in the figure, as also enlarged views of the egg from which it is developed.

FIG. 10—EUDRYAS GRATA; *a*, the caterpillar in natural size; *b*, its fifth segment enlarged; *c*, its collar; *d*, markings of the hump on the eleventh segment; *e*, an upper view of the egg; and *f*, a side view, each enlarged from the natural size shown beside them.

Those who may desire further information of these two insects, and of two other species, of which the larvæ resemble them closely, are referred to an article in Professor Riley's sixth Missouri report, entitled "The Blue Caterpillars of the Vine," in which corrections are made of confounding of larvæ in preceding reports; and to one contained in my "Entomological Contributions, No. 3" (Twenty-sixth Annual Report on the New York State Museum of Natural History, 1874), entitled "On the Larva of Eudryas unio and Allied Forms."

Remedies.

Where the vines are not very large the conspicuously marked caterpillars of either of these two species can be easily discovered upon the leaves when they have attained a sufficient size to be of material damage. If those which can be reached from the ground or by the aid of a ladder, be gathered and destroyed the ravages will be greatly lessened. If the extent of the vine is too great for hand-picking, or the operation proves disagreeable from the green liquid that the Alypia caterpillar commonly ejects when handled, I would recommend, as the most economical and safest method of dealing with the caterpillars, showering while they are still young with hot water by means of a garden hose attached to the hot-water faucet of the kitchen, if accessible. The water, partly cooled by its passage through the air, will probably not retain sufficient heat to injure the plants, but quite enough to kill the caterpillars which it reaches, for as a rule the lepidopterous larvæ can not endure any great degree of heat. If insecticides need to be used, pyrethrum water or a kerosene emulsion would be efficient.

When nearly mature, numbers of the Alypia caterpillar can be made to drop to the ground if the vines that they infest be suddenly shaken or brushed, when they can be gathered and killed. Dropping them in a can containing a little kerosene is a convenient method of killing them, as well as all other hand-picked insects.

Phobetron pithecium (Sm.-Abb.).

The Hag-Moth Caterpillar.

(Ord. Lepidoptera: Fam. Bombycidæ.)

Phalæna pithecium Smith-Abbot: Nat. Hist. Lep. Ins. Geo., ii, 1797, p. 147, pl. 74.

Ecnomidea pithecium Duncan: in Nat. Lib.—Entomol., vii, 1841, pp. 183–186, pl. 21, f. 3 ♀, 4 larva.

Limacodes pithecium Harris: Rept. Ins. Mass., 1841, p. 304; Ins. New Eng., 1852, p. 324; Ins. Inj. Veg., 1862, p. 421, figs. 208, 209; Entomolog. Corr., 1869, p. 244–5.

Limacodes pithecium. FITCH: in Trans. N. Y. St. Agricul. Soc. for 1856, xvi, p. 381; 3d Rept. (3d-5th) Ins. N. Y., 1859, p. 63, No. 85.

Limacodes pithecium. MORRIS: Synop. Lep. N. A., 1862, p. 127.

Phobetrum pithecium PACKARD: in Proc. Ent. Soc. Phil., iii, 1864, p. 340; Guide Stud. Ins., 1869, p. 290; Ins. Inj. For.-Sh. Trees,—in Bull. No. 7, U. S. Ent. Commis., 1881, p. 47.

Limacodes pithicium. RILEY: in Amer. Entomol., ii, 1870, pp. 25, 340, f. 209; 5th Rept. Ins. Mo., 1873, p. 126 (stinging power).

Phobetron pithecium. LINTNER: Ent. Contrib. No. III — in 26th Rept. N. Y. St. Mus. Nat. Hist., 1874, p. 149 (on hazel); in Count. Gent., xlvii, 1882, p. 745 (general notice); id., liii, 1888, p. 725.

Phobetron pithecium. SAUNDERS: Ins. Inj. Fruits, 1883, p. 112, f. 111 (habits, food-plants, etc.).

Phobetron pithecium. DIMMOCK, A. K.: in Psyche, 1885, p. 280 (bibliography).

Phobetron pithecium. HUBBARD: Ins. Affect. Orange, 1885, p. 142-3, figs. 62-3.

Perhaps the strangest, queerest looking caterpillar that is to be found among all of the known Lepidoptera of the United States, is the one named above as "the hag-moth caterpillar," and (imperfectly) illustrated in Fig. 11. It never fails to enlist attention and excite curiosity when for the first time its motion attracting the eye shows it to be a living creature; but its wonderful mimicry of bits of dead and curled or eroded leaves is usually the cause of its being passed over without observation. Its peculiar shriveled appearance together with its dark color, is thought by Dr. Harris, to have suggested to Sir J. E. Smith, who first described it in the beautiful and costly volumes on the "Rarer Lepidopterous Insects of Georgia," the specific name of *pithecium*, the meaning of which is a shriveled and monkey-faced old woman. And from the same characters, undoubtedly, the common name that it bears of the hag-moth caterpillar has been drawn.

Description of the Caterpillar.

It belongs to a group of Bombycid caterpillars which, from their slug-like form and gliding motion, without apparent feet, are known as "slug caterpillars," and scientifically as *Cochlidiæ*. Indeed, some of the species, but for their bright and often varied colors and the broad spines that they bear, would naturally be mistaken for slugs. *Pithecium* is about an inch in length, apparently headless as seen from above, thick-bodied, of the form shown in the figure, of a dark brown color, and clothed with a velvet-like down over the low tubercles which the rings bear. Projecting from each side are four long, tapering, flattened, curling, velvety appendages, such as might suggest a miniature octopus. Of these, the pair near the front, on

FIG. 11.—The hag-moth caterpillar, PHOBETRON PITHECIUM.

the middle and near the end, are nearly as long as the body, while the terminal pair are about one-third as long. There are also other shorter ones intermediate to these. These appendages * are strongly constricted at their base and so slightly attached to the body that they are easily broken off. They are always cast off, together with a number of other subtriangular smaller ones, before the construction of the cocoon, and ordinarily several of them will be found woven fast to the outside of the cocoon.

It is strange that while the peculiar and interesting larval form is not a rarity in some portions of the United States, no detailed description has been given of it from which the number, form and location of these appendages may be learned. The figures that we have do not supply the want; they disagree in structural features, and in one we are presented with thirteen distinct segments, exclusive of the head, with a probable fourteenth. Dr. Fitch states that "the sides of its body are prolonged in eleven, tooth-like processes." In the absence of specimens of the larva to compare with this representation, I will quote from notes made by me on two examples received by mail which were in the larval stage when sent. "The box contained two cocoons (the caterpillars having spun up en route) and fifteen of the velvety arms (some are frequently lost during growth). Besides these, there were also fifteen subtriangular velvety pieces which had been borne upon the more prominent lateral tubercles, of which there are probably four on each side."

Its Stinging Power.

The caterpillar is named by Riley in a list of thirteen, mostly *Cochlidiæ*, whose spines have an urticating power.† A few others possessing this power have since been added to the list, as exceptions to the rule that caterpillars may be handled with impunity and without fear of their stinging, biting, poisoning or inflicting any other harm, notwithstanding the strong jaws, liquid secretions, bristling spines, and formidable horns with which they are provided as if for both defense and offense. The almost universal fear or dislike of caterpillars is unreasonable — is not natural and would not prevail but for erroneous and culpable teaching in childhood. Careless habit, or undeveloped powers, of observation fail to note the jointed legs with which most caterpillars are provided, and they are therefore relegated to the class of creeping or crawling things — so closely

* No suitable name has been found for them. Fitch designates them as "tooth-like processes;" Harris as "flattened teeth;" Hubbard as "fleshy hooks."

† *Fifth Report of the Insects of Missouri*, 1873, p. 126.

associated in many minds with snakes; hence, children in infancy are taught that everything that creeps must be avoided, and every snake, however beautiful, innocent, and in movement the embodiment of grace, must be killed. Such ignorance is to be deplored. It results in the overlooking of much that is worthy of admiration and study, tends to the development of cruelty towards the lower forms in nature, and is often the occasion of much unnecessary fear and alarm. For example: A newspaper account that obtained wide circulation not long ago, and was doubtless believed by many, made of one of our harmless caterpillars, the common tomato-worm (of which hundreds have been handled by me, without having experienced even the slightest nip from their jaws), a creature more venomous and more to be dreaded than the rattlesnake. If disturbed, it would inflict a mortal sting with the horn on its tail, and it was capable of ejecting a venom to a distance of several feet, which was certain death to whomever it struck.

I have no personal knowledge of the stinging power of the hag-moth caterpillar. It certainly can not exist to any great extent, for it is unprovided with such urticating spines as are found in *Lagoa crispata*, and are so conspicuous in *Hyperchiria Io* and *Hemileuca Maia*. I do not recall any spines or hairs that would serve the purpose, but Mr. Hubbard, who is more familiar with it, states that they occur among the feathery brown hairs with which the "fleshy hooks" (arms) are clothed, as longer, black, stinging hairs.

Miss Emily L. Morton, of New Windsor, N. Y., who probably has had more experience with the caterpillar than anyone else, has written in reply to inquiry made: "Although I have handled dozens of them every year, for some time past, in all stages and of all ages, I have never yet discovered any indications of a power to sting — such as is possessed by *Lagoa crispata* (in my experience the very worst of all stinging insects), *Empretia stimulea*, or even the somewhat painful though only momentary sting of *Euclea querceti* or *Parasa Chloris*." The testimony of Mr. Herman Strecker is to the same effect; he has written of it: "This little worm has a Victor-Hugo devil-fish sort of look, but can not sting, and is perfectly harmless."

Its Degree of Abundance.

The caterpillar does not often come under notice of the field collector, and from the comparatively few examples of the moths that are to be found in our collections, it may properly be regarded as a rare insect in the northern States. Dr. Harris records an instance in which, on the testimony of an agricultural friend, "a swarm of these caterpillars appeared on a cherry tree and nearly stripped it of its

leaves," but as it is not stated that the caterpillar was identified by Dr. Harris, it is not at all improbable that some other larva may have been mistaken for it, although its remarkable appearance should prevent its being confounded with any other. Mr. Hubbard seems to have met with it in abundance in the orange groves of Florida and to have had favorable opportunities for observing its habits, for he informs us that he found it to display "the extreme of instinctive sagacity in a device to which it frequently resorts when unable to find a suitable place in which to weave its cocoon, in making itself more satisfactory surroundings by killing the leaves, upon which, after they have become dry, it places its cocoon." Mr. Hubbard states: "Several of these caterpillars unite together, and, selecting a long and vigorous immature shoot or leader of the orange tree, they kill it by cutting into its base until it wilts and bends over. The leaves, in drying, turn a light tan-color, which harmonize most perfectly with the hairy locks of the caterpillar covering the cocoon." The above notes of habit are apparently based on observations made upon numbers of the caterpillar, and would almost indicate a social disposition never observed in the northern States.

Food-plants of the Larva.

I have had the larva, on different occasions, feeding on the apple, crab-apple, and pear. One example was found by me, at Bath, near Albany, feeding on hazel, *Corylus Americana*. Dr. Harris states that it occurs on forest trees, cherry trees, and apple trees in New England, from July to September. According to Mrs. Dimmock, it is often found on the white birch, *Betula alba*. Abbott gives persimmon [*Diospyros Virginiana*] and the various kinds of oaks as its food. Other food-plants given for it are plum, wild cherry, white and red oak, and orange. To these, MS. notes of Miss Morton, kindly submitted to me, add, sugar-maple (*Acer saccharinum*), ash, witch-hazel (*Hamamelis Virginica*), and chestnut (*Castanea*). Larvæ had been reared by her from eggs found on chestnut and sugar-maple. Those from the former grew more rapidly and attained larger size.

The Cocoon.

This caterpillar shows a disposition to spin itself up in its cocoon at any time after its last molting, under the provocation of a temporary withdrawal from, or an imperfect condition of, its food, or possibly from confinement and exclusion from light. In almost every instance in which it has been sent to me by mail, it had either inclosed itself in its cocoon when received, or proceeded to do so the day

thereafter. This peculiarity has been noticed in *Actias Luna* and others of our Bombycids, and in *Aglia tau* of Europe.* If shared by many of the *Cochlidiæ*, it may be the explanation of the failure that so generally attends the efforts to rear their larvæ to the imago stage.

The cocoon is oval and parchment-like, as are those of *Euclea*, *Empretia*, and *Limacodes*, which are more frequently met with. In nature, it is said to be formed usually between leaves. Confined in a box, it is quite as often attached to the sides as to the leaves that may be therein. The one fed by me on hazel spun its cocoon on the surface of some damp sand, fastened to the twig standing therein. The outside of the cocoon was covered with grains of sand, and in its upper portion were interwoven some of the long arms which have been described as characteristic of the larva. It was broadly oval, slightly flattened on the sides, measuring three-tenths of an inch by four-tenths, being about the form and size shown in the accompanying figure, although described by Mr. Hubbard as "almost spherical — bullet-shaped." Compared with *Empretia stimulea* Clemens, it is less elongated, for in that we have the proportion of 0.32 to 0.50 in.

FIG. 12.—Cocoon of the hag-moth caterpillar, PHOBETRON PITHECIUM.

The attachment of several of the hairy arms of the caterpillar to its cocoon, which is usually a feature of it, is probably the result of the chance projection of the arms through the meshes of the frame-work of the cocoon, the difficulty of withdrawing them with the threads clasping their contracted base, and the ease with which they would be torn off in the contortions of the caterpillar in its close quarters, seemingly so disproportionate to its size. This dismemberment of its ornamental appendages, so often remarked upon by writers, would, therefore, appear to be involuntary and a necessity, rather than intentional, and for any purpose that it might serve in the economy of the insect.

The cocoon, in giving out its moth, opens by a circular lid in one end, made for the purpose by the larva during the construction of the cocoon. With no example at hand for examination, I am not able to state whether the lid displays even an approach to the remarkable ingenuity shown by the *Lagoa crispata* larva in the building up of the lid of its cocoon with hinge and an inner guard to protect from outward pressure.†

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* *Entomological Contributions*, No. III — *Twenty-sixth Rept. N. Y. St. Mus. Nat Hist.*, 1874, p. 153.

† *Entomological Contributions*, No. II, 1872, p. 38 — *Twenty-fourth Rept. N. Y. St. Mus. Nat. Hist.*, 1872, p. 142.

Description of the Moth.

Female.—The front wings are narrower than in most of the *Cochlidiæ*, prolonged apically, and with rounded angles. They are yellowish-brown medially (nearly reaching to the costal margin), and outwardly forming a wavy band of five flexures which is bordered within by a similar band of a darker shade, and without by a narrow dark brown lunulated band which begins on the costa near its outer third, and following the curve of the wing approaches nearer the outer margin as it proceeds, is bent sharply inward beneath the cell, and thence descends in a perpendicular line to the inner margin. A similar toothed line crosses the wing just within its middle. (These lines have not been very well shown in the figure; they are not uniformly developed in all examples of the moth.) A large rounded, pale, yellowish-brown spot, which is darker within, rests on the inner margin beyond its middle. A dark brown shade-band runs near the outer margin. At the outer end of the cell is a small black spot. The basal portion of the wing is dark brown with some fuscous lines.

FIG. 13.—The female hag-moth, PHOBETRON PITHECIUM.

The hind wings are somewhat broader than the front pair, pointed at the apex, and so short as not to reach the end of the abdomen. The fringes of both pairs of wings are spotted with dark brown. The legs are hairy and tufted; the tibiæ (shanks) of the middle pair bear a conspicuous tuft of long pale yellow hairs. Antennæ simple. Expanse of wings, about one inch.

Male.—The front wings are narrower than in the other sex and less rounded at the angles. The colors are similar but darker, limited almost to the inner margin, the rest being thinly-scaled or transparent. The hind wings with their acute angles are almost rhomboidal in shape; their anterior half is transparent. The antennæ are broadly bipectinated. The abdomen bears a terminal tuft of ochreous hairs. Expanse of wings about three-fourths of an inch.

FIG. 14.—The male hag-moth PHOBETRON PITHECIUM.

The abdomen of my only example is apparently brown, but it is greased, and the entire moth is in too poor condition, from injuries incurred in its breeding-cage, for accurate description. Miss Morton, who has been favored with the privilege of seeing many of the males flying around the cage of confined females, describes the abdomen of the male as steel-blue, like that of the blue-bottle fly.

But Little Published of the Insect.

As almost nothing has been published on the history and habits of this interesting insect and knowing that Miss Morton had given particular attention to the *Cochlidiæ* and had been very successful in rearing them, I requested, if not desired for publication by herself, that she would permit me to introduce in the present notice, such notes as she might be able to give upon this insect. In response, she has very kindly communicated the following interesting and valuable contribution :

Life-history and Habits, as Observed by Miss Morton.

The egg.— "The eggs of the Limacodes bear no resemblance to any other species of Heterocera with which I am acquainted. Most of them would be invisible on a leaf as they are perfectly transparent. Even on white paper, the ova of *Parasa fraterna* are most difficult to find, and only by holding them against the light, a slight, shiny appearance is to be observed like a minute drop of dew.

"The eggs of *P. pithecium* are very flat, nearly an ellipse though slightly truncate at one end. When newly laid they are like tiny drops of transparent gelatine, of a pale brownish color, becoming darker with age and the development of the embryo larva. In ten days the eggs usually produce their larvæ, but if the nights are cool they develop more slowly, requiring twelve and sometimes fourteen days to reach maturity.

The larvæ.— "Of the young larvæ I know but little, as the only year in which I was successful in rearing them, I took no notes, and for the past three years, although the eggs developed, all of the larvæ died without emerging. From memory, those that I reared looked, on hatching, exactly like the mature larva in miniature, having the same brown cimeter-shaped processes covered with a soft fur-like clothing, but with the processes shorter in proportion to their size and less curved. They are of very slow growth, eggs hatching in the middle of July taking until the last of September and even into October before the larvæ made their cocoons. They did not fully mature until the nights became cold and the leaves changed on the chestnuts, which seemed to be their favorite food-plant.

The cocoon.— "The cocoon is of a dark chocolate-brown, with the usual 'lid' of all the Limacodes. The furry appendages of the larva are fastened to the outside of the cocoon, but adhere to it so slightly that they soon drop off unless handled very carefully.

The moth.— "In emerging, the moth leaves its transparent pupal-case projecting half-way from the cocoon. It seems to be very regular

in the season of its making its appearance from the pupa, for in three consecutive years it occurred on the third and fifth of July. The moths escape from the cocoons quite early in the morning. The males take wing and seek their mates from about 9.30 to 10.30 A. M. The mating ordinarily continues for three hours, although sometimes prolonged until the evening. The female begins to fly and deposit her eggs between 8.30 and 9 in the evening, placing them singly (in confinement), or more rarely in groups of four to eight. Abroad, seldom more than two eggs are placed on a leaf.

Habits of flight.—"*Pithecium* is the only Limacodes known to me which seeks its mate in broad daylight and bright sunshine. If the day is rainy the male will not fly. I do not know whether the great difference between the sexes has been noticed by observers, or the very strong resemblance that the male presents to a blue-bottle fly. When on the wing seeking its mate, its steel-blue abdomen and semi-transparent wings, together with the buzzing noise that it makes, would almost lead anyone to take it for a 'blue-bottle' unless acquainted with its habits. On warm and bright days the males will at times be seen swarming, to the number of fifteen or twenty, about the cage of a newly emerged female placed out of doors, coming suddenly, circling and buzzing around it, and as suddenly darting away with a swiftness that the eye can not follow."

To the above notes of Miss Morton, I would add: The eggs of *P. pithecium* (some of last year that failed to develop their larvæ were kindly sent to me) are the most remarkable looking objects of all the insect eggs that I have ever seen. Certainly no one unacquainted with them and meeting with them abroad, and not seeing them deposited by the moth (perhaps not even then) would suspect their nature. They are simply minute, flattened discs, showing no elevation as viewed from above, but only a slight circular depression within. When examined obliquely or against the light, the depressed line is seen to define the outline of the young larva curved so that the head and tail nearly touch, and occupying about one-half of the diameter of the egg. The greatest thickness of the egg is about one-half that of the thin sheet of paper to which they are attached. In size they hardly exceed an ordinary "fly-speck," measuring in the longest diameter 0.075 of an inch. Their color is a pale yellow-brown. Certainly, the egg is as peculiar, extraordinary, and as ludicrous as is the larva.

The statement of Miss Morton that the cocoons of *pithecium* are made the last of September or even in October is confirmatory of the

remarks made on page 188 on an apparent habit of the larva of inclosing itself in its cocoon prematurely, under certain conditions. Examples sent to me by mail, and, of course, subjected to unnatural treatment in their boxing, etc., have made their cocoons as early as in August. My notes — all the dates bearing on this point that I have — show the following, which will be seen to be quite in contrast with Miss Morton's experience with her carefully matured larvæ:

Larva, August 4, on pear; cocoon made August 6.
Larva, August 22, on apple; cocoon made August 24.
Larva, September 2, on hazel; cocoon made September 16.
Larva, September 3, on pear (fruit); cocoon made September 5.
Larva, September 4, on crab-apple; cocoon made September 7.
Larva, September 9, on pear; cocoon made September 12.

Parasites.

Miss Morton has sent me a Tachina fly which she has bred from *pithecium* which I can not separate from unnamed examples in my collection, marked "bred from Limacodes sp?" The slug caterpillars are apparently very liable to Tachina attack. Miss Morton feelingly remarks, in writing of the example sent: "It looks to me like all the grey Dipteræ infesting the Limacodes which so often render a summer's hard work abortive by their emergence from the empty skin of the mature larva just as it is about to form its cocoon."

Anisota senatoria (Sm.-Abb.).

The Yellow-striped Oak Caterpillar: The Senatorial Oak Moth.

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

SMITH-ABBOT: Lepidop. Ins. Geo., ii, 1797, p. 113, pl. 57 (larva, pupa, ♂ & ♀ imago). As *Phalæna.*

HÜBNER: Verz. Schmett., 1816, p. 193, No. 1979 (as *Anisota*).

HARRIS: An.-Pl. Mass., 1835, p. 72; Rept. Ins. Mass., 1841, p. 292; Ins. New Eng., 1852, p. 312; Ins. Inj. Veg., 1862. p. 405–6, f. 198 (larva), 199 (pupa), 200 (♀ imago); Entomolog. Corr., 1869, p. 298, pl. 2, f. 9 (larva), pl. 4, f. 12 (pupa). As *Dryocampa.*

WALKER: Cat. Lep. Brit. Mus., 1855, Pt. VI.

FITCH: 5th Rept. Ins. N. Y. (3d.–5th Repts.), 1859, p. 43.

MORRIS: Synop. Lep. N. Amer., 1862, p. 231.

PACKARD: in Proc. Ent. Soc. Phila., iii, 1864, p. 385; in Bull. No. 7, U. S. Ent. Comm., 1881, p. 45 (habits, etc.).

GROTE: in Proc. Ent. Soc. Phila., iii. 1864, p. 93 (restores *Anisota* Hübner); in Proc. Amer. Philosoph. Soc., xiv, 1874, p. 260 (place in classif.).

WALSH: in Pract. Entomol., ii, 1866, p. 7 (in Wisconsin).

GLOVER: in Rept. Comm. Agricul. for 1870, p. 83, f. 43 (larva).

Boisduval: in Ann. Soc. Ent. Belg., xv, 1871-2, p. 87, pl. 3, f. 5 of larva (*Adolecephala*).
Lintner: Ent. Contrib., No. II, 1872, p. 51-2; and in 24th Rept. N. Y. St. Mus. N. H., 1872, p. 155-6 (larval notes).
Treat: in Amer. Agricul., xxxiii, 1874, p. 344 (habits).
French: in 7th Rept. Ins. Ill., 1878, p. 196 (brief description); in 10th Rept. do., 1881, p. 120 (larva described).
Coquillett: in 10th Rept. Ins. Ill., 1881, p. 161 (larva described).
Clarkson: in Papilio, ii, 1882, p. 188 (abundance in Columbia Co.).
Claypole: in Canad. Entomol., xv, 1883, p. 36 (abundance in Penn.).
Dimmock, A. K.: in Psyche, iv, 1885, p. 275 (bibliography and food-plants).

The caterpillar of this species, although it may not claim high rank in a list of our insect enemies as the cause of serious harm and pecuniary loss, yet, it at times presents itself to our notice in such vast numbers, and its defoliation of the trees that it infests is so marked and startling, that it is not strange that fears are ofttimes entertained lest its ravages should extend to other vegetation which would at once transform it into a formidable pest. To meet the inquiries that are from time to time made of its habits, and the information that is desired of it, the following somewhat extended account has been prepared, from notes made several years ago and from published notices in scattered works, many of which are named in the bibliography above given.

The Egg-laying.

The large and conspicuous moth, which will be noticed hereafter, was observed by me at Center, N. Y. (now Karner), July 7, 1869, depositing its eggs on the under surface of oak leaves, distributing them over the surface in large patches, in a single layer, in close contact with one another. A leaf of *Quercus prinoides* of ordinary size was plucked, which had one-half of its surface covered with the eggs. From a count of a portion of the deposit, and an estimate of the remainder, the number of eggs was 500. This may be accepted as the ordinary number from a single moth — usually placed in separate patches on a leaf, or on two or more leaves.

The female, doubtless, oviposits soon after emerging from the pupa. Her abdomen is so greatly distended with her burden of eggs that she is unfitted for flight and almost helpless. On one occasion my attention was drawn to some commotion in the sand of a roadway at Center, not recognized at the distance, when, on approaching nearer, it was seen to be a female *senatoria*, which was being knocked and rolled helplessly and ludicrously about in the ardor with which a half-dozen males flying above and around her were striving for her possession.

Larval Stages.*

First stage.—Larvæ from eggs collected on July seventh hatched on the eleventh. The head of the newly-hatched larva, after assuming its proper color, is glossy black and of an oval form. The body is pale yellow-green, with a few short hairs; on the second segment are two smooth, straight, subcylindrical, black horns, arising from a green base, and with a slight enlargement at their apex, where they give out two black diverging setæ of the length of two-thirds that of the horn.

The young larvæ feed in company, and occupy both surfaces of the leaf, the entire substance of which they consume, except the veins and veinlets, leaving frequently a very good skeleton of the leaf.

The *first molting* occurred on the eighteenth and nineteenth of July. At this stage the body is obscure green with seven fuscous lines, of which the dorsal and stigmatal ones are narrow; the subdorsal and lateral ones broader, having in them a row of short spines. The collar (on first segment) centrally and the anal segment shining black. Legs black; prolegs with a black spot outwardly.

Second molt.—July twenty-eighth and twenty-ninth. Length of larva, 0.37 of an inch. Head and collar glossy black. Horns slightly spinose, enlarged at the tip, and usually with apical spines. The abdominal stripes are black, with yellow-brown intermediately, showing a broad stigmatal stripe. The terminal segment is spinose and glossy black.

Third Molt.—August fourth and fifth. Length, 0.60 of an inch. The larva is glossy black, with eight yellow stripes, of which the lower one is geminated by a crescent on the central portion of each segment inclosing a spinule; ventrally, from the fifth segment, is a yellow-green interrupted stripe. The horns are slightly tapering, clubbed at their tips, a d 0.20 of an inch long. The legs and prolegs are black.

Fourth Molt.—Extending from August fourteenth to sixteenth. Immediately following the molting, the head, collar, horns, anal shield and plates, and legs, are flavescent; in a few hours they became shining black. The horns are but slightly enlarged at their tip, being less so than previous to this molt. The body is covered with numerous shining, minute, elevated points of the color of the ground on which they are placed.

* From my *Entomological Contributions*, No. II (*loc. cit.*), of which a few copies only were published.

The Mature Caterpillar.

The larva when full-grown is two inches long and about the thickness of a lead pencil, cylindric, and of a coal-black color in stripes alternating with orange-yellow, as follows: Along the middle of the back is a black stripe, with a yellow one of the same width on each side of it. Outside of these is a broader black stripe followed by a yellow one on each side of the back, slightly broader than the two middle ones. Below these is another black stripe still wider than the one above, and below this along the sides are two yellow stripes with a black one between them in which the breathing-pores are placed. The upper of these last two yellow stripes is somewhat wavy and less smooth than those on the back, and the lower one is often widened on the fore part of each segment, or sends off a branch downward and backward [not shown in the figure]. Below this is an oblong yellow spot on each segment, which is sometimes lengthened to unite its anterior end to the yellow stripe. The under side is black with a yellow stripe along the middle, which is more or less interrupted. The legs and prolegs are black. The yellow stripes are not prolonged on the posterior and two anterior rings, but are here often replaced by small yellow spots. The head is black. The skin is tough and leathery, with numerous small, elevated, smooth grains, of which two on the fore part of each segment, placed in the yellow stripes, are larger and are sometimes elevated into small prickle-like points, and two others, similar to these, also occur posteriorly on each segment, but placed further apart. In addition to these, there are six larger, black, shining, conical prickles in a transverse row around the middle of each ring, some of which are occasionally forked at their tips into two sharp points. On the second ring in place of the two upper prickles, are two black curved cylindrical horns, equaling two of the rings in length and usually standing obliquely upwards and forwards, their tips blunt and shining. The last segment is rough from several prickle-like points of different sizes. (Fitch, in *Fifth Report Insects of New York*, [third to fifth reports] p. 43–44.)

FIG. 15.—The yellow-striped oak caterpillar, ANISOTA SENATORIA.

Abundance of the Caterpillar in New York.

Dr. Fitch, writing of it, states: "The latter part of August, 1858, I observed them in greater numbers than I had ever before seen, in the cemetery at Saratoga Springs, where they had stripped most of the oaks of their leaves, and were then descended from the trees, probably in search of food elsewhere, as few of them appeared to be grown to their full size. They were everywhere crawling sluggishly about upon the surface of the dry, sandy soil, and up the sides of the monuments. In the paths, the dresses of the ladies sweeping over them, these worms frequently adhered to and crawled up them, to the great annoyance of everyone and the alarm of the more timorous."

In former years, they were found annually in great abundance at Center, N. Y. This locality was their metropolis until within a few years past, since which time the fires that have repeatedly swept over it have banished the superabundance of insect life that for so long a time made it perhaps the most noted insect hunting-ground of the northern United States. In the more favorable years for its multiplication, it abounded so excessively that all of the smaller oaks which were so numerous there, occurring in extended areas to the exclusion of other shrubs or trees, were, during the month of August, as effectually defoliated as if they had been swept by fire.

Dr. James Eights, a distinguished naturalist, for many years a resident of Albany, has informed me that on one occasion he observed on the line of the railroad between Albany and Schenectady, a species of caterpillar so exceedingly abundant on and about the railroad track, that the numbers crushed by the passage of the trains caused the slipping of the wheels of the engines to such an extent as to necessitate the sanding of the rails before the train could proceed. A notice of the interesting incident was communicated by him to one of the journals of the day, in which some account of the caterpillar was given. Although, from the number of years that had elapsed since the event he was not able to indicate positively the species, he believed it to have been *A. senatoria*, and the locality of its occurrence, in the vicinity of Center.

Mr. F. Clarkson has recorded (*loc. cit.*) a remarkable prevalence of the caterpillar at Livingston, Columbia county, N. Y., in the year 1882. It appeared in the latter part of June, and before the middle of August the larvæ had consumed all the leaves of the young oaks, and had visited many of the older trees standing in lawns and on the borders of forests.

Elsewhere than in New York, it has been reported as fearfully numerous along the Michigan Central railroad. "For three years the oaks near Kalamazoo have been entirely denuded of their leaves, and nearly all the trees first attacked have died." (*Report of the Commissioner of Agriculture* for 1869, p. 536.)

At New Bloomfield, Pennsylvania, in 1882, according to Prof. Claypole (*loc. cit.*), great ravages were wrought by it in the forests. He states: "I have seen hillsides that looked as if fire had passed over them, in consequence of the destruction of the foliage by millions of the species. In the woods they could be found crawling over almost every square foot of ground, and lying dead by dozens in every pool of water. The sound of their falling frass was like a slight shower of rain. Farmers tell me that they had never known them so abundant before within their recollection."

Its Food-plants.

The caterpillar was believed to feed exclusively on the different species of oak, until recently, when Mrs. A. K. Dimmock, of Cambridge, Mass., has added white birch (*Betula alba*) to its short list of food-plants. To what extent it was observed to feèd thereon is not stated (see *loc. cit.*). Messrs. Walsh-Riley have recorded an instance in which the eggs of the moth were laid on raspberry leaves (*Amer. Entomol.*, ii, 1869, p. 26), but it was probably under the constraint of inability to reach an oak for oviposition, and it is doubtful if the larvæ when hatched would have fed on the raspberry.

Dr. Harris states that in Massachusetts they live on the white and red oaks [*Quercus alba* and *Q. rubra*]. Professor Claypole observed the white oak to be untouched by them at New Bloomfield, Pa., and their food to be almost exclusively the foliage of the black-oak (*Quercus tinctoria*), the scarlet-oak (*Q. coccinea*), and the bear or scrub-oak (*Q. ilicifolia*). In my own observations at Center, they have usually occurred on the dwarf chestnut-oak (*Q. prinoides*) and on the black scrub-oak (*Q. ilicifolia*).

Its Distribution.

Although originally described from specimens collected in Georgia, it is far less abundant in the southern States than in the northern.* Its eastern range is apparently from Canada to Georgia. To the westward it is reported in published lists from Wisconsin (Walsh), Missouri (Riley), Kansas (rare, Snow), and California.

It seems to be rather a local insect. Dr. Fitch mentions the fact that he had never met with it at Salem, Washington county, where he resided, while it was very abundant only twenty-five miles distant. In my collections, extending over many years, it has never been seen by me in abundance in any other locality than at Center.

Stinging Powers.

This caterpillar is another of the few that are capable of inflicting a sting when handled. It is not as severe, however, as those of the *Cochlidiæ*. According to Dr. Fitch, its prickles, if they happen to penetrate the skin, produce a stinging sensation like that of nettles and a slight redness of the spot; both these symptoms, however, lasting but a short time, as in the case of nettle stings.

It is not included in the list of stinging larva by Prof. Riley, referred to on page 185, although mention is there made of the sting of *Anisota stigma*, on the authority of Dr. Fitch.

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*Prof. Geo. F. Atkinson, entomologist of the South Carolina Agricultural Experiment Station, at Columbia, represents this species as by far the most common Anisota in middle North Carolina. *A. rubicunda* is there frequently met with in broods on the maple, and twice he had found broods of *A. stigma* (Bull. No. 4, Jan., 1889, *So. Car. Agr. Exper. St.*, pp. 87-8.)

I have no recollection of having felt the sting of either this species or *Dryocampa rubicunda*. With the other Anisotas I am not familiar, they being rare in the State of New York.

Natural Enemies.

As would seem to be indicated by the remarkable number in which this insect often occurs, its known enemies are but few. Its formidable spines doubtless serve to protect it from destruction by insectivorous birds, although Professor A. J. Cook names two species that are known to eat it, viz., the robin and the blue jay [*Merula migratoria* and *Cyanocitta cristata*]. (*American Naturalist*, viii., 1874, p. 368.)

Of insect parasites, I only find recorded, *Limneria fugitiva* Say — a common parasite of the *Bombycidæ*. In its parasitism of the young larva of *senatoria*, in making its cocoon it uses the body-wall of its host, which it eats through and fastens to a twig of the tree on which the larvæ are feeding (Atkinson). From some of the parasitized larvæ, Professor Atkinson had obtained examples of a species of *Hemiteles*, but he could not determine whether it was a primary parasite on *A. senatoria* or a secondary one on *Limneria fugitiva*.

Another ichneumon parasite, reared from the caterpillar, is in my collection, undetermined, but unfortunately can not be found at the present for identification.

Description of the Moth.

The female has the thorax, abdomen, and wings of a bright ochreous-yellow color. Its front wings are freckled with blackish dots; a large white spot rests on the lower part of the cross-vein of the cell near the upper middle of the wing; and a faint purplish stripe runs, slightly waved, from just before the apex to the outer third of the inner margin. The hind wings are much smaller, angulated apically, a brighter ochreous toward their hind margin, and a straight purplish band traversing them behind their middle. Its antennæ are short and simple. Expanse of wings about two and one-half inches.

The male is much smaller in size, being about one inch and a half in spread. It is of a darker color; its front wings are triangular, feebly dotted with black, the white spot quite distinct, the purple traversing line inconspicuous especially toward its middle, where the wing is somewhat translucent. The hind wings are rhomboidal, with the purple line only indicated. The antennæ are broadly pectinated for more than one-half their length.

Summary of Life-history.

The moth may appear abroad in the State of New York for oviposition as early as the second week in June. On June sixteenth I have seen examples *in coitu* and females depositing their eggs.

The eggs hatch in from a week to ten days. The young caterpillars feed together in swarms, and, according to Harris, "have their regular times for eating and for rest, and when they have finished their meals they cluster closely together along the twigs and branches; if disturbed they raise the forepart of their body and shake the head to signify their displeasure." They undergo four moltings, and their five stages seem to average about nine days each.

During the latter part of July and in August the defoliation of the oaks that they cause is noticed. An oviposition extending over three or four weeks will naturally give varied degrees of growth of the larvæ met with abroad. Thus, notes made by me in 1869 show on August twentieth, larvæ quite small, some passing through their fourth molt, and others in their last stage; August twenty-seventh, full-grown larvæ; September eighth, matured larvæ on their travels prior to pupation; September fourteenth, still abundant; thirtieth, a few seen; the locality was not visited in October.

The larger number probably enter the ground for pupation during the second and third weeks of September. They bury to a depth of three or four inches, where they shape a small and simple cell in which to undergo their change to pupæ.*

When the time for the last stage in the series of transformations has arrived, the pupa, aided by the circlet of spines or teeth with which the front of each of its free-moving segments is provided, and by a strong bifid anal spine, forces itself to the surface and partly out of the ground, where it is held while the moth bursts its case and emerges. The females are at once attended by the males that have preceded and are awaiting them, and the pairing usually occurs in the grass beneath the oaks, according to Mr. Clarkson, before there is time to ascend the trunks. Soon thereafter the eggs are laid, as before described, on the lower surface of the leaves of the terminal twigs of the branches nearest the ground, seldom exceeding an elevation of ten or twelve feet.

Associated Species.

The two other species of Anisota, viz., *stigma* Fabr. and *pellucida* Sm.-Abb.,† also feed on the oaks, but they never occur in injurious num-

* It is of interest in this connection to mention that *Anisota Heiligbrodti* Harvey (*Canad. Entomol.*, ix, 1877, p. 110), since referred, by Grote, with *bicolor* Harris, *bisecta* Lintn., etc., to the genus *Sphingicampa*, has a pupation above ground in a double cocoon like that of *Cecropia* and *Promethea*, but net-like instead of solid, and attached to the mesquite (*Entomologica Americana*, i, 1885, p. 60).

† Mr. Grote, in his last Check List, and in a list of *Ceratocampadæ*, etc., published in 1874, has cited *pellucida* as a synonym of *Virginiensis* of Drury. I do not know why this reference was made, and believe that it has not been accepted by those entomologists, at least, who are unwilling to abandon a name, particularly when expressive and characteristic, as in this instance, which has been in general use for more than a century, unless the necessity for so doing is clear and unquestionable, and not simply resting on probabilities.

bers. *Dryocampa rubicunda* (Fabr.), often cited as *Anisota*, although having some other food-plants, is usually found on the maples (*Acer dasycarpum* and *A. saccharinum*), which it occasionally despoils of nearly all their foliage, particularly in some of the western States. It will, however, in confinement feed on oak leaves.

Remedies.

It will not often be necessary to resort to means for protection from the injuries of this insect, as the oaks that they feed upon in preference, and on which they occur in the largest numbers, are those that ordinarily occupy sandy tracts (as at Karner, N. Y.) or other unproductive places. When, however, their attack is made upon oaks that are valued for ornament or shade, it may be arrested by spraying the foliage with London purple in water.

Mr. Clarkson believes that its multiplication may be restrained by destroying the moths on their first appearance while among the grass beneath the oaks where their larvæ abounded the preceding year, and by trimming off the lower branches of the trees so that the foliage can not be easily reached by the heavy-bodied females, for oviposition.

Another remedy that has been recommended, for a similar larval attack, is to dig a trench, around an infested tree, of about a foot in depth, with its outer wall sloping inward, into which the caterpillars as they leave the tree for pupation will collect, and where they can be conveniently destroyed by crushing or by sprinkling with kerosene. A trench with the two walls sloping upward toward one another would be a still more effectual trap.

Agrotis saucia (Hübner).

Larva: *The Variegated Cut-worm.* Moth: *The Unarmed Rustic.*

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

HÜBNER: Samml. Europ. Schmett., 1796, 378 (*Noctua*); Verzeich. Bek. Schmett., 1816, 227 (*Peridroma*).

TREITSCHKE: Schmett. Eur., v., 1825, p. 149 (*Agrotis*).

HARRIS: Ins. New Engl., 1852, p. 344 (moth described); Ins. Inj. Veg., 1862, p. 444 (*A. inermis*).

GUENÉE: Spec. Gen. Lep.— Noct., i, 1852, p. 271 (remarks on larva).

STAINTON: Man. Brit. Moths, i, 1857, p. 224 (brief descriptions of moth and larva).

BOISDUVAL: in Ann. Soc. Ent. France, ser. 3, vii, 1859, Bull., p. 102 (ravages in tobacco plantations in Algiers).

RILEY: 1st Ann. Rept. Ins. Mo., 1869, pp. 72-74, pl. 1, figs. 1-4 (descriptions and life-history, as *A. inermis*); 3d id., 1871, p. 129 (parasite from); in Rept. Comm. Agricul. for 1884, p. 297-8, pl. 3, figs. 1, 2 (notes on eggs and larva).

SPEYER: Europ.-amer. Verwantschaften, in Stett. Ent. Zeit., 1870, p. 107; id., 1875, p. 134.

GROTE: List. Noct. N. A., in Bull. Buff. Soc. Nat. Hist., i, 1873, p. 135 (identical with *A. inermis* Harris); id., ii, 1874, p. 11; id., 1875, pp. 308, 314; in 6th Rept. Peab. Acad. Sci., 1874, p. 22 (Eur. and Amer.); in Bull. G.-G. Surv. Terr., vi, No. 1, 1881, p. 163.

MORRISON: in Proc. Bost. Soc. Nat. Hist., xvii, 1875 (in Texas, and identical with *A. Ortonii* Pack.).

FRENCH: in Trans. Ill. Hort. Soc., xi, 1877, pp. 192–194 (habits, etc.); in 7th Rept. Ins. Ill., 1878, pp. 94–5, 211–213 (description, habits, food-plants, etc.).

LINTNER: Ent. Contrib., IV (in 30th Rept. N. Y. St. Mus. Nat. Hist.), 1878, p. 45 (dates of collection), p. 53 (in Patagonia); in 44th Rept. N. Y. St. Agr. Soc. for 1884, pp. 62, 63, 64 (food-plants), 68; in 39th Ann. Rept. [N. Y.] St. Mus. Nat. Hist., 1886, pp. 94, 95; in Trans. N. Y. St. Agricul. Soc. for 1888, pp. 71, 74, 75, 79, 85; Bull. N. Y. St. Mus. Nat. Hist., No. 6, 1888, pp. 8, 11, 12, 16, 22, figs. 11, 21.

MARTEN: in 10th Rept. Ins. Ill., 1881, p. 134 (description and habits of larva).

From Mr. P. Barry, of the Mount Hope Nurseries at Rochester, N. Y., some apple twigs, containing an egg-deposit from which the larvæ were emerging, were received on May seventh. The eggs had been sent to him for name, from Centralia, Kansas.

The Eggs.

The twigs were quite small, not exceeding one-sixth of an inch in diameter. The eggs were closely and symmetrically arranged, in a single layer, in regular rows joined to one another, forming an unbroken patch. In one example there were seven rows of about sixty eggs in each, extending over about an inch and a half of the twig. The eggs, upon the point of hatching, were of a lavender color. They were round, with about forty sharp and prominent longitudinal ribs, which were connected somewhat irregularly with numerous transverse lines. In Figure 16, at *a*, one is shown in enlargement, and at *b*, a twig with one of the egg-deposits is represented.

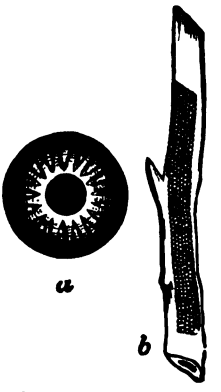

FIG. 16.—*a*, an egg of AGROTIS SAUCIA greatly enlarged; *b*, eggs of the same deposited upon a twig, natural size.

Desiring to learn more of the occurrence of the eggs, I addressed a request for the information to Mr. A. Oberndorf, Jr., of Centralia, Kansas, from whom the eggs had been sent to Mr. Barry. The following communication was sent in reply, under date of May twentieth:

Up to the seventeenth inst. I have found the eggs on the *twigs* and *bodies* and *branches* of young apple, pear, and peach trees, but

have found none on old or bearing trees. I found the eggs in batches, on twigs, in narrow strips from one inch to three inches long, and about three-sixteenths of an inch broad; on branches, in broader strips from one inch to two and one-half inches long and from one-fourth to three-eighths of an inch broad; on the bodies of trees, usually about in this shape and size,* and the eggs as close together as possible. I destroyed every nest that I could find, but concluded last Sunday to leave two nests in a little tree to see what they would do after being hatched. On Monday one-half of the cluster had changed from a light tan to a slate color, and yesterday evening that portion had hatched, and a number of little caterpillars, about one-eighth of an inch long, were wriggling about, but were gradually being carried away by the wind.

Larval Transformations and Habits.

First stage.— Some of the eggs had hatched when received from Mr. Barry, and the caterpillars presented the following appearance:

The head was black, the body green with indistinct lines, and a few scattered hairs. They had but three pairs of prolegs, and consequently looped in walking, after the manner of the *Geometridæ*. In dropping from the twig, they hung suspended by a thread that they gave forth. When disturbed they would often twist the head and several segments over the back, holding to the surface upon which they rested by the last two pairs of prolegs.

Grass was offered them of which they readily ate and with apparent relish. Some tips of apple twigs being given them, a few fed sparingly thereon, eating small holes into one surface of the unfolding leaves, but much the larger portion continued their feeding upon the grass.

Second stage.— Upon the fourteenth of May some of the caterpillars were observed to have undergone their first molting, and to have acquired in the operation an additional pair of prolegs. They were cylindrical, of a length of 0.2 inch, the head somewhat cordate with black setiferous spots; body with a pale dorsal line, two similar lateral ones, and a broad stigmatal stripe; the anterior pair of trapezoidal spots are black, elevated, and bear, as do the other setiferous spots, a stout black hair. The hinder part of the body slopes downward to the anal prolegs. There are now four pairs of prolegs.

Third stage.— Several of the larvæ had undergone their second molting on the morning of May eighteenth. They had now five pairs of prolegs (the normal number belonging to the *Noctuidæ*), and presented the following features:

Head dull yellowish, pale on the side, mottled, with two broad fuscous lines in front running from the summit of the head to the

* Referring to a rectangular figure given of about one inch by three-fourths, not continuously straight-lined on one of its longer sides.

palpi, curving toward one another and connecting mesially like an)((see this feature represented in the adult head at *b*, in Figure 17); last joint of the palpi black. Body cylindrical, bearing short black hairs on the setiferous spots, brown, shading darker toward the broad substigmatal yellow-brown stripe, a subdorsal black line shaded with yellow beneath, and a yellowish dorsal line accentuated into yellow spots on the summit of each segment, especially upon the third, fourth, fifth, and sixth (not counting the head as one); on top of the eleventh segment, a v-shaped black patch; beneath pale brown with delicate mottlings. Prolegs pale, semitranslucent. The setiferous spots are elevated and shining black. The larval length at about the end of this stage, is 0.55 inch.

The distinctive markings of this stage, are the pale lateral stripe, the fuscous dorsum (paler in many examples) and the dorsal line of yellow markings — the anterior ones of which are either rounded or lozenge-shaped and the following ones becoming elongated into lines.

During this stage and onward to maturity, the brood was fed on plantain leaves (*Plantago major*), for which they manifested a great fondness. They were not easily disturbed in their feeding when brought under observation. When removed by hand to fresh leaves they simply curled up in the usual cut-worm manner, without showing any alarm.

Fourth stage.— The third molting commenced on May twenty-first, and was completed in about two days. Their length at the end of the stage was 0.8 inch. The lines of the head are shining black, broader comparatively than before, and yellowish on the sides. Body, general coloring as before; about six conspicuous yellow dorsal spots, a black subdorsal line somewhat broken, with yellow beneath; resting on the line of the spiracles, a broad black band broken into crescents having the spiracles in one tip. The stripe beneath this is greenish with yellowish dots and beneath this, over the legs, greenish with whitish dots; a triangular black spot on the top of the eleventh segment and a yellowish patch behind it.

Fifth stage.— The fourth and last larval molt commenced on the twenty-fifth of May and was completed by the brood, 150 in number, on the twenty-eighth. Of larvæ fully matured on the thirtieth, the following are the prominent features:

Maximum length, 1.6 inch; average length of six examples, 1.46 inch, breadth, 0.25 inch. Colors not so bright or so contrasting as in previous stages — the prevailing shade being a sordid brown. The conspicuous features are: The yellow dorsal spots on the hinder part of segments two to seven inclusive, consisting of three or four trans-

verse markings on the obscure annulets; the dorsal black patch on the eleventh segment; an interrupted subdorsal black line consisting of a black streak on the posterior half of each segment; the stigmatal line of black crescents and the substigmatal line of a yellowish, approaching orange, color. The spiracles are small and black. One of the paler colored larvæ is represented at *a* in Figure 17.

At maturity.— By the thirtieth of May, many of the larvæ had ceased feeding and had evidently matured. The following day they were transferred to a box of earth upon which a layer of plantain leaves had been placed. When examination was next made on the third of June, a little feeding had been done. Four-fifths of the larvæ were found above ground, and the rest had buried themselves at different depths — some just beneath the surface, showing a slight contraction in length, indicating progress toward pupation. A few that had been transferred to a separate box with food, were still feeding on June fourth.

The Pupa.— On the fifth of June, three newly-disclosed pupæ were found beneath leaves on the surface of the ground — at first of a dull pale yellowish color, but later becoming mahogany-brown. The anterior segments following the rounded head-parts are cylindrical for the extent of the wing-covers, while the remaining six free segments rapidly diminish in size to the anal tip, which is armed with a single short, black, curved spine. The anterior margin of the segments is brown and closely punctated. Length, 0.7 inch; greatest breadth, 0.2 inch.

The Moth.— The first moths — eight in number — emerged from their pupæ on the twenty-fourth of June, and on the following day eighteen others made their appearance. The duration of their pupal stage would thence have been twenty days, and their larval stage twenty-eight days. The last of the moths, 150 in all, were given out on June thirtieth. The species proved to be very easy to rear, unlike most of the cut-worms — hardly any fatality attending any of the several transformations. The moths displayed a remarkable absence of timidity on being disturbed. With hardly any motion beyond the necessary readjustment of their legs, they could be lifted from the ground upon which they rested

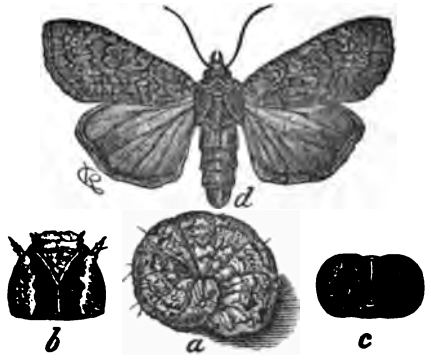

FIG. 17.— AGROTIS SAUCIA — *a*, larva; *b* and *c*, head and a middle joint of the same enlarged; *d*, the moth.

or from the sides of the box to which they were attached, by slipping a piece of paper underneath them, from which they could be quietly dropped in the cyanide bottle. If alarmed, they attempted escape by running rather than flight.

The form, size and general appearance of the moth are shown in Figure 17. Its general ground color is a uniform brownish-gray, but individuals differ greatly in color, a large number being found having the costal region of the forewings nearly black while the rest of the wing is yellowish-brown. Others have the front of the wings blackish, gradually shading into the usual brownish-gray. A variety is mentioned by Riley in which the costal region is of a dull golden-buff color, but this does not appear in the large brood reared by me, nor have I met with it in ample collections of the species abroad.

An Injurious Species.

The variegated cut-worm is regarded as one of the most injurious of its class, from its numbers, its great voracity and the broad range of its food. It apparently will attack almost any field-crop that it may find convenient for its operations, and when these are not at hand, it as readily feeds on grasses and weeds. In cold-frames, it has been quite destructive to lettuce. In conservatories it has been very injurious to smilax, *Myrsiphyllum asparagoides*, eating off the softer parts and especially the tops of the plants. In its attack on cabbage, it has imitated the habits of some of the boring species, by penetrating directly into the head. In Kansas, in 1885, it was very injurious to clover and timothy in Johnson, Meade and Douglass counties — in the latter stripping off the leaves of the clover and cutting off the heads of timothy early in June (Professor Snow, in *Rept. Kansas St. Bd. of Agriculture* for June 1885, p. 6).

Its Food-plants.

In confinement it has been fed on knot grass, corn, leaves of peach, apple, strawberry, willow, eupatorium, tips of grapevine, plantain, etc. Kaltenbach states that in Europe it feeds on *Stellaria* [chickweed], *Litorella*, *Plantago* [plantain], and *Rumex* [dock, sorrel]. Rouast credits it with feeding on roots of grains, under the lucernes and trefoils, *Centranthus ruber*, *Plantago*, *Rumex*, *Daucus* [carrot], and *Carduus*. He quotes Milliere as saying that it does not eat roots but only leaves.

A Double-brooded Species.

Professor Riley remarks (p. 298 of *Rept. Comm. Agricul.* for 1884) that his St. Louis notes (given) of eggs of the species hatched from April ninth to May twenty-fourth, and moths emerged from June fifth to July fifth, "indicate at least two annual generations, with a possibility of three." In my collections at sugar, at Schenectady, N. Y., in

1875, the first brood had entirely disappeared at my commencement on July second. The first individual of the second brood was taken on September seventh, and others following on the ninth, eleventh, thirteenth, fifteenth, twentieth, twenty-ninth, thirtieth, October second, fourth, tenth, nineteenth, and twenty-second—on each evening except seven, when the collections were made (*Entomolog. Contrib.*, IV, p. 45). The following year, 1876, the first brood was evidently delayed in the time of its appearance, as it was taken only between July eighteenth and August third. No collections at sugar were made during the autumn, and I have, therefore, no record of the appearance of the second brood of that year.

Its Geographical Distribution.

It is a species of very broad distribution, being found throughout most of Europe; in Canada and British Columbia; in the United States from the Atlantic to the Pacific; in South America, in Colombia, Brazil and Patagonia; and in the Madeira and Teneriffe islands.

Remedies.

The remedies for attack of this species of cut-worm, as indicated by what has been above given of its life-history and habits, should be, in general, such as give best promise of killing the larvæ when concealed during the day under leaves, or just beneath the surface of the ground when no better shelter is offered. Large numbers may be easily destroyed by poisoning them with prepared baits of their favorite foods when they come abroad to feed at night during the month of May, and crushing the pupæ by thorough plowing while buried at a moderate depth in the ground during late May or early June, or, as more practicable, toward the latter part of August. For remarks upon these methods, and for other remedies and preventives available against cut-worms as a class, see *Bulletin No. 6 of the N. Y. State Museum of Natural History*, on "Cut-worms," lately published; and the same in the *Transactions of the N. Y. State Agricultural Society*, vol. xxxiv, for the years 1883–1886.

Mamestra picta *Harris.*

The Zebra Cabbage Caterpillar.

(Ord. Lepidoptera: Fam. Noctuidæ.)

Harris: Ins. N. Engl., 1852, p. 350–1; Ins. Inj. Veg., 1862, p. 451–2, f. 223 (larva), f. 224 (pupa); Entomolog. Corr., 1869, p. 317–18 (larval description and dates).

Guenée: Sp. Gen. Lep., v.—Noct. i, 1852, p. 344, pl. 5, f. 8 (as *Ceramica exusta*—moth described).

WALSH: in Pract. Entomol., ii, 1866, p. 21 (immunity to frosts, etc.)
RILEY: 2d Rept. Ins. Mo., 1870, p. 112, f. 82 *a* (larva), *b* (imago); in Rept. Comm. Agricul. for 1883, p. 124–5, pl. 1, figs. 3, 3a, pl. 12, figs. 2a, 2b (*Ceramica*—description, habits and transformations).
LINTNER: in 26th Rept. N. Y. St. Mus. N. H. for 1872—Ent. Contrib., III, 1874, p. 137–8 (*Ceramica*—larval description and habits); 2d Rept. Ins. N. Y., 1885, p. 1–2 (on beets); 4th Rept. do., 1888, p. 16 (on currant); Bull. N. Y. St. Mus. N. H., No. 6, 1888, p. 21, f. 24.
GROTE: in Bull. Buff. Soc. Nat. Sci.—List Noct., 1874, pp. 22, 123 (*Ceramica*); Check List N. A. Moths, 1882, p. 26, No. 343 (*Mamestra*).
THOMAS: 6th Rept. Ins. Ill. [1877], p. 60; 9th Rept. do., 1880, p. 51–2 (*Ceramica*).
FRENCH: in 7th Rept. Ins. Ill., 1878, p. 226 (*Ceramica*).
COQUILLETT: in 10th Rept. Ins. Ill., 1881, p. 185, figs. *a*, *b* (*Ceramica*).
PACKARD: in Amer. Nat., xviii, 1884, p. 1266–7 (larval stages described).
CAULFIELD: in Canad. Entomol., xvi, 1884, p. 122–3 (Ophion parasite).
WEED: in Bull. Ill. St. Lab. N. H., iii, 1887, p. 2 (Microplitis parasite).

This conspicuously marked caterpillar, shown, together with the moth produced by it in Figure 18, which is so injurious to many kinds of vegetation, has often been described and figured in its mature form, but only a few brief notes of its earlier stages have been given. Examples sent by Mr. George T. Powell, from Ghent, N. Y., June 8, 1887, found feeding in company on a currant bush, enable me to supply the deficiency.

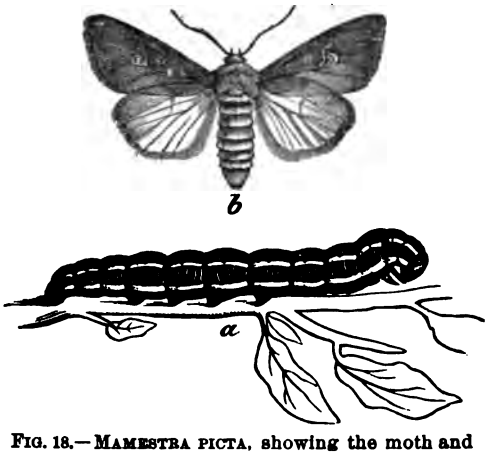

FIG. 18.—MAMESTRA PICTA, showing the moth and its caterpillar.

The Young Larva.

The larvæ were 0.35 inch in length, and cylindrical in form. The head is pale red, and nearly as broad as the body. The body is traversed dorsally by a bluish-white mesial stripe, except as it is interrupted at the incisures on the posterior segments by the coalescing of the two well-defined black stripes that, commencing on the white collar of the first segment, elsewhere border it. Below this is a distinct bright yellow subdorsal stripe, broader than the black one above it, in which, on the hinderpart of each segment, is a small, black setiferous tubercle—its seta a little longer than the breadth of the stripe; these tubercles, on the posterior segments, are merged

into the black stripes above. Next below is a broad, black, lateral stripe, traversed by an irregular white one, which is contracted on each segment so as to leave thereon a large rounded black spot united with the lower margin of the black stripe. The stigmatal stripe, next in order, is yellow, somewhat narrower than the subdorsal yellow one, bearing a row of black setiferous tubercles, similar to those in the superior yellow stripe, of which the anterior ones are merged in the black above. Below this, and centrally, the body is blackish, paler mesially. The legs and prolegs are reddish, the latter with a black patch outwardly.

The larvæ, at this time, have molted twice — possibly three times.

From the above details, it will be seen that the caterpillar is marked with seven distinct stripes, viz., three black ones (a dorsal and two lateral) and four yellow ones (two subdorsal and two stigmatal).

The Nearly Mature Larva.

In the stage previous to the last molt, the broad, dorsal black stripe is traversed medially by a narrow white line, and is marked on the hinderpart of segments three to nine with two small white dots. The broad, black lateral band consists of the black runic markings, with white interspaces, characteristic of the last stages of this larva.

A Peculiar Parasitic Attack.

In this stage six of the caterpillars disclosed a parasitic attack. In each instance, underneath the last segment of the larva, and usually placed transversely to it, an elongated brown cocoon, about twice as long as broad, was found attached.* Its formation was not observed. The diameter of the cocoon about equals that of the caterpillar. The parasitic larva may have emerged through the anus, as no rupture in the skin was observed. The cocoons were formed June twenty-second to June twenty-sixth. The cocoon and the insects emerging therefrom (date not known) are identical with those subsequently described by Mr. Clarence M. Weed (*loc. cit.*), of the Ohio Agricultural Experiment Station, as *Microplitis mamestræ*.

Transformations.

On the twenty-seventh of June the larvæ had matured and entered the ground for pupation. The moths emerged August eleventh to eighteenth, and deposited eggs, the earliest of which hatched August twentieth.

It will be observed, from the above, that there are two broods of this insect each year — the first of which appears abroad in the winged state about the latter part of May, and deposits the eggs for

* Mr. Weed found the cocoons "fastened transversely between the anal prolegs."

the summer brood. The caterpillars from these, feeding through June, produce their moths in August. From these, again, we have the caterpillars which are so destructive to autumnal crops in September and October, which pupate in the latter month, and pass the winter in that stage.

The larvæ obtained from the eggs on August twentieth enable me to give their features at an earlier stage than that previously given.

When just from the egg, they measure one-twelfth of an inch in length. The head is black, and the flesh-colored body bears rows of rounded, black, setiferous spots — the superior four of which on each segment form the "trapezoidal spots." The hairs are black. The larva loops in walking, as only six of the prolegs are employed in locomotion.

Food-plants.

In addition to the list of food-plants of this caterpillar (apparently rather a general feeder on garden crops) given by Professor Riley, viz., cabbage, turnip, beet, spinach, strawberry, asparagus, honeysuckle, mignonette, asters, lamb's quarters (*Chenopodium album*), may be added from my own observations, sweet pea, field pea, currant, and buckwheat.

On July 3, 1884, Mr. Goff sent from the Agricultural Experiment Station at Geneva, larvæ of from three-eighths to one-half inch long, which may have undergone two molts, that were infesting, to a serious extent, peas and cabbage on the station grounds. For mention of a severe attack by the caterpillars on a mangold crop, in St. Lawrence Co., N. Y., in 1883, see my 2d report.

Remedies.

It is comparatively easy to deal with this insect while in its early stages when it is of social nature and feeds in companies. At this time the leaves containing them may be plucked and crushed by the foot.

Later, they may perhaps be best destroyed by pyrethrum powder, to which they are quite susceptible, as shown by the following experiments made:

Undiluted pyrethrum was scattered over five larvæ, less than half-grown. They were very soon in violent convulsions, squirming and twisting as if in great agony and discharging a green liquid from the mouth. In a half hour's time they were unable to turn from one side to the other, and only gave contractile movements. In three-fourths of an hour motion had nearly ceased. In one hour and a half they were motionless and seemingly dead.

Pyrethrum of the dilution of one part to five of flour was slightly dusted through a sieve over five larvæ. In three minutes time, they had ceased traveling and were violently squirming. In fifteen minutes time, they were barely able to turn themselves over. In one-half hour they showed no more motion than did those which had been treated with unmixed pyrethrum after the lapse of an hour. The experiment clearly showed that the diluted powder was not only quite as efficient as the undiluted, but even more rapid in its effect.

Mamestra grandis (*Boisd.*).

A Poplar-feeding Cut-worm.

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

Hadena grandis BOISDUVAL: Gen. Ind. Eur. Lepidop., 1840, p. 950.

Hadena grandis GUENÉE: in Ann. Soc. Ent. France — Noct. Eur. Ind. method., 1841, p. 244; Spec. Gen. Lep., vi.—Noct., ii, 1852, p. 105, pl. 8, f. 10.

Mamestra grandis GROTE: List Noct. N. A., in Bull. Buff. Soc. N. S., ii, 1874, p. 12.

An irregularly rounded cluster of the eggs of this cut-worm was taken at Center, N. Y. (Karner), on the 14th of June, 1887, on the leaf of a poplar, *Populus tremuloides*. They were not identified at the time, nor even later when the larvæ had been reared from them, nor until the moths were obtained the following winter.

Eggs of other of the cut-worm moths have been taken from various trees. As there is no record of the larvæ of such species feeding upon the leaves where the eggs occur, we may presume that immediately upon hatching, the young larvæ drop to the ground and commence to feed upon the tender blades of grass. It is possible, however, that some of the species may creep at night from their hiding places — in crevices in the bark of the tree in their younger stages, and in the ground when more advanced — to feed upon the leaves unobserved, as *Agrotis Cochranii* and others of the "climbing cut-worms" are known to do. That this may be their habit seems plausible from the food upon which this family of *M. grandis* was reared. Their cut-worm nature not being suspected from their egg or larval features, poplar was supposed to be their natural food-plant and it was accordingly given them immediately upon their hatching. It was readily accepted, and continued thereafter to be eaten with apparent relish. They even consented to a transfer to other species than *P. tremuloides*, when, hav-

ing been carried with me in the Adirondack mountains, that particular specie of poplar, at times, could not conveniently be obtained.

The following is the account of the successive stages of *Mamestra grandis* as observed by me:

The egg.—The egg is round, ribbed with about twenty-four lines and punctured in the intermediate depressions. Color, a pale purple, an elongate deep purple dash at the apex, and a purple band near the summit not entire. The colors were probably the result of the larva partly showing through the translucent shell, as the hatching was near at hand, and the empty egg-shells were left nearly colorless.

Larva in first stage.—The larvæ were hatched on the fifteenth of June. They were quite small, slender, elongated, with long legs and numerous black spots from which long hairs proceeded. They are very active in their movements. When ready for their molting, they are of a pale, watery-green color, with three pale (whitish) stripes on each side; between the two lower is a dusky stigmatal stripe. The black, setiferous, trapezoidal spots are quite distinguishable, and of these the two anterior ones of the central segments, are about one-half as far apart as the hinder pair. Length when fixed for molting, 0.3 inch. Four pairs of prolegs are used in walking in this stage.

Second larval stage.—The first molting was on June twenty-second. The head is flat, pale brown, with a few dark spots. The body, bluish-green; a narrow, whitish, dorsal line; two lateral lines, then a dark stigmatal one, having a white stripe below. Ventral region pale green. The fifth pair of prolegs are partly developed, but not employed in locomotion, as the larva still loops.

Third stage.—Commencement of second molting not noticed, but was on or about the twenty-seventh of June. General color, darker green; a whitish dorsal stripe, a similar lateral one, a broad dark green stigmatal one, below which is a pale green stripe, bordered on each side with white. Head, brown, flat, bilobed, with numerous hairs. Body tapering anteriorly from the eleventh segment; the setiferous spots with comparatively shorter hairs. Of the five pairs of prolegs, the anterior pair is used in walking, but as they are shorter than the others, the larva still has a looping gait. It feeds principally at night; when disturbed, it coils up and bends its head on one side. At this stage, it eats holes in the body of the leaf and not from the edge as before. Length when in readiness for its next molt, 0.7 inch.

Fourth stage.—Molted on or about July second. Color, pale brown, a whitish dorsal line, two obscure lateral ones, and a stigmatal and

substigmatal whitish one. Head nearly as large as the first segment, pale brown with two darker lines down its front and paler reticulations on the sides. Body cylindrical. All of the prolegs are fully developed and there is no looping in walking.

Fifth stage.— On July ninth the larvæ were observed in their fourth and last molting. At maturity, they measure when at rest 1.5 inch, and are nearly cylindrical in form; when extended in motion they are two inches long with the body tapering quite regularly from the eleventh segment to the head. The head is bilobed above, flattened in front, brown, with darker brown reticulations. The body is an obscure pale brown, with indistinct dark brown mottlings, smooth, except the usual setiform spots, each with a short white hair; trapezoidal spots dark brown and inconspicuous — the anterior pair contiguous. Beneath, paler; legs unicolored.

The larvæ were fed on poplar leaves to maturity.

Pupation.— First change to the pupa on July twenty-first — the last on July thirtieth — about thirty in all. Most of the larvæ declined to enter the ground that was given them, but pupated on the surface. After their pupation they were covered lightly with earth. A few buried two or three inches in the ground, where they made rude cocoons of earth by spinning together the surrounding soil in walls of about one-fourth of an inch in thickness.

Disclosure of the Imago.— The pupæ were kept during the winter in a warm room, having a temperature of 70° Fahr. and above. Although the breeding-case in which they were placed was supplied underneath its wire floor with an evaporating pan to furnish needed moisture, very few moths were disclosed. The first emerged in January, 1888 — three examples prior to January twenty-first. A second and third example followed during the month, and four others in February; and although the pupæ seemed in good condition for months thereafter, and some occasionally worked their way to the surface when covered only with a thin layer of earth, no other examples of the moth were obtained. The moth bears such a general resemblance to *Hadena Arctica* (Boisd.), that it was at first mistaken for it. It is represented in Fig. 19.

FIG. 19.— MAMESTRA GRANDIS.

Distribution.

Mamestra grandis has rarely occurred among the large collections of *Noctuidæ* made in the vicinity of Albany during the years 1877 and 1878 by Messrs. Meske, Hill, Bailey, Chatfield, and others. It is

recorded as having been taken rarely in Ohio and Illinois. Beyond this, but little is known of its distribution in the United States. It is said to occur in the circumpolar regions of Europe. Boisdaval received examples of it from Greenland and Lapland.

Penthina nimbatana (Clemens).

The Rose-leaf Tyer.

(Ord. LEPIDOPTERA: Fam. TORTRICIDÆ.)

CLEMENS: in Proc. Acad. Nat. Sci. Phila., 1860, p. 364 (*Antithesia*).
WALKER: in Cat. Lep. Heteroc. Br. Mus., xxviii, 1863, p. 374 (*Penthina contrariana*).
ZELLER: Beitr. Kennt. nordamer. Nachtf., iii, 1875, p. 57, pl. 8, f. 13.
FERNALD: Cat. Tortric. N. Amer., 1882, p. 31, No. 187.
COQUILLETT: in 11th Rept. Ins. Ill., 1882, p. 12 (reference to); in Papilio, iii, 1883, p. 101 (larval features and habits).
LINTNER: in Count. Gent., xlviii, 1883, p. 169 (in a green-house).

Caterpillars of this moth were received from Scarsdale, Westchester Co., N. Y., on February seventh, with a statement that they had just made their appearance in a green-house and were injuring the foliage. Some method of destroying them was desired.

They are of small size, as are most of the family of *Tortricidæ* to which they belong, not much exceeding one-half inch in length, slender, and nearly cylindrical. They are of an apple-green color, of a transparency that permits the pulsation of the dorsal vessel (corresponding to a heart) to be seen through the skin, and are traversed by a dark dorsal line. The twelve segments of the body are well defined, each bearing several small tubercles or papillæ which give out a small white hair — the four on the back (the trapezoidal spots) being the most conspicuous. The head is flat and shining black, with some whitish hairs, and the collar (upper part of the first segment) is also shining black. The three pairs of legs are black; the prolegs green.

This species was named and described by Dr. Clemens as *Antithesia nimbatana*, in 1860, and was later referred to the genus *Penthina*. It is a common species in the vicinity of Albany.

Mr. D. W. Coquillett states (*loc. cit.*) that he has found the caterpillar of this species to be "utterly indistinguishable from a black-headed variety of *Cacœcia rosaceana* (Harris)." I have not compared the two, but the moths are so exceedingly unlike that their larvæ certainly should show differential features. From my recollection of the larva of *P. nimbatana*, its green is more yellowish and clearer than

is ever seen in examples of *P. rosaceana*. A number of the pupa-cases of both species are contained in the State collection, awaiting study which will undoubtedly show marked difference in them.

Food-habits.

With me the insect has shown a decided preference for some clumps of one of the commoner roses, not very double, which grow in clusters on the same stem, and entirely avoiding some of the choicer kinds. This same preference has been observed and mentioned to me by others. The explanation may, perhaps, be that this particular rose is apparently not very far removed from the wild rose, *Rosa blanda*, which, according to Mr. Coquillett, it infests, and from which he has bred it.

This is the first time that the insect has been reported in green-houses.

Life-history and Habits.

The parent moth, shown in its natural size in Fig. 20, comes from its pupa about the middle of April in ordinary seasons, in the State of New York, for the deposit of its eggs. They are laid at night, and presumably on the terminal leaves of rose bushes, just as they are pushing out from the buds. The eggs have not been observed, nor the moth in its oviposition, at this season of the year. The caterpillar soon hatches, and at once commences to bind together the margins and surfaces of the folded leaf. I have found it thus located on the last day of April, measuring one-eighth of an inch in length. With its increasing size, the single leaf, partly eaten and opened out in its rapid growth, is abandoned by the caterpillar, which then selects another habitation, and a more commodious one, between the surfaces of two leaves fastened together. This, in turn, at a more advanced stage of growth, is deserted for still more ample quarters among several of the terminal leaves of a tip. Within the shelter thus provided for itself, it feeds upon its immediate surroundings and is never seen abroad. Its growth is rapid, and at its successive moltings the papillæ and the hairs proceeding from them become more conspicuous. Immediately after its molting, and for a while thereafter, its head and collar are green, assuming slowly their normal black and shining color.

FIG. 20.—Moth of the rose-leaf tyer. PENTHINA NIMBATANA.

By the last week of May the larvæ have matured, ceased feeding, and, it would seem, have dropped to the ground, to undergo their transformations among the dead leaves, as I have not been able to find their pupæ among the folded or fastened leaves of the bush. When reared in confinement they have transformed within a folded

leaf which the caterpillar had first lined with a coating of silk. The period of pupation is about nine or ten days. The moth of the second brood has been observed abroad by me as early as June second. Eggs are laid for the next brood, and the renewed operations of the caterpillar upon the bushes are soon to be seen, extending into July. It is possible that there may be a third brood, as the transformations among the *Tortricidæ* may be quite rapid — the pupal stage in some being limited to five days. I have seen the moths flying in my garden as late as July twenty-fifth — the latest period at which I have been able to pursue my observations upon it. From June second to the last days of July, and probably into August, would be too long a time for moths of the second brood to be seen abroad. It would be more in accordance with what is known of other Tortricids if a third brood made its appearance about the middle of July.

FIG. 21.-Front wing of the rose-leaf tyer, enlarged. (After Zeller.)

Remedies.

The presence of this caterpillar on a rose bush may be detected at a glance by the tied leaves at the tip of a stem, when it is only necessary to give the little bunch a slight pinch, and its occupant is at once destroyed. As it is seldom so numerous as to call for insecticidal applications to the entire bush, which would require to be very thoroughly applied in order to reach its food, this will be found the most convenient and efficient method of destroying the pest. It is the method that I have adopted in my own garden, where it is an annual visitant, and where its pretty, broad-winged and conspicuously marked moth is often to be seen by day during the months of June and July, resting upon the leaves, or if disturbed, flying quickly for a yard or two to a fence-board or other convenient resting place, and presenting much, in the pose of its wings, the appearance of some of the smaller *Noctuidæ*.

Incurvaria acerifoliella (Fitch).

The Maple-leaf Cutter.

(Ord. Lepidoptera : Fam. Tineidæ.)

Ornix acerifoliella Fitch: in Trans. N. Y. St. Agricul. Soc. for 1855, xv, 1856, pp. 501–505; 1st and 2nd Repts. Ins. N. Y., 1856, pp. 269–273, pl. 4, figs. 5–7; in Count. Gent., xiv, 1859, p. 225.

Incurvaria acerifoliella Clemens: in Proc. Acad. Nat. Sci. Phila., January, 1860, p. 4; in Tineina of N. Amer., 1872, p. 90 (fig. of wings and brief description).

Ornix acerifoliella. REED: in Rept. Ent. Soc. Ont. for 1872, p. 42-3.— LINTNER: in Count. Gent., xxxix, 1874, p. 631.

Tinea iridella CHAMBERS: in Canad. Ent., v, 1873, p. 86.

Incurvaria iridella CHAMBERS: in Canad. Ent., xi, 1879, p. 146; in Bull. U. S. G.-G. Surv. Terr., iv, 1878, p. 151.

Incurvaria acerifoliella. CHAMBERS: in Bull. U. S. G.-G. Surv. Terr., iv, 1878, p. 151 (references).— PACKARD: in Bull. No. 7, U. S. Ent. Commis., 1881, p. 114 (habits and description).— WALSINGHAM: in Trans. Amer. Ent. Soc., x, 1882, p. 172; in Insect Life, i, 1888, p. 147.— LINTNER: 1st Rept. Ins. N. Y., 1882, p. 308 (mention).— FLETCHER: Rept. Entomol. for 1885, p. 31-2 (severe injuries); id. for 1887, p. 38 (mention); in Trans. Ottawa Field Nat. Club, ii, 1887, p. 353-4 (injuries).

This little Tineid, for some unknown reason, is remarkably local having been reported from only a few localities in the United States and Canada; yet when it makes its appearance, it is usually so destructive to the foliage of the trees that it attacks, and its operations are of such a peculiar character as to impart much interest to them.

The following communication, received from a correspondent residing at Pittsford, Vt., tells the story of a demonstration made by it at that place:

Inclosed I send you some leaves from the sugar maple, upon which you will find a small worm covered with portions of the leaf which he has cut out and appropriated for a house; he carries it about and feeds upon the leaf until it is all consumed but the fiber. Nearly all the hard maple trees in our forests are as brown and look as dead as though fire had been through them. We have never seen anything of the kind here before, and I would like to know where they came from and what their future will be. They touch no other tree but the hard maple; not even the soft maple. Any light in regard to the insect will be thankfully received.

The Leaf-case of the Caterpillar.

The leaves sent with the above present a curious appearance and would naturally arrest attention and provoke inquiry. In one of them are no less than twenty-two round (or more correctly, subelliptical) holes, of from one-tenth to four-tenths of an inch in diameter, while several of the pieces, neatly cut out from the holes, are fastened to the upper surface of the leaf. A large portion of the surface has been eaten away in such a manner as to leave frequently circular patches of green untouched surface, corresponding in size and form to the excised pieces of leaf.

Upon inserting the point of a needle under the edge of one of these pieces, it is found to be attached to the leaf by silken threads at different parts of its circumference. On raising it, underneath is seen a

smaller round piece, and within these two, when separated, two other pieces of smaller size, containing within them the remains of a minute caterpillar which had been killed, probably by pressure in transit through the mail.

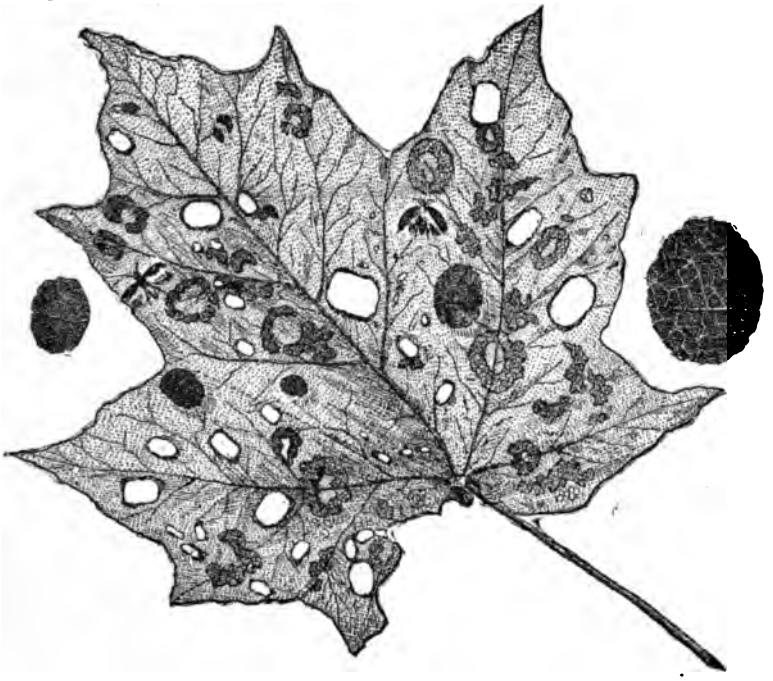

FIG. 22.—The maple-leaf cutter, INCURVARIA ACERIFOLIELLA, and its operations. (After Fitch.)

When the leaves were received, a few of the leaf-cases which had escaped crushing were observed in motion, as the caterpillars, with head and front legs protruded, were dragging them over the surface in search of fresh pasturage, as stated in the above communication.

In Fig. 22 the operations of this insect on a maple leaf, as above described, are shown, as also two of the moths upon the leaf in their natural size. Three of the larval cases, in different sizes, are represented on the leaf. At its left is the case of a full-grown larva, in natural size, and to the right the same enlarged.

The Insect, and its Appearance in New York in 1850.

The insect which constructs for itself this singular shelter, and inflicts the serious injury on the forest maples mentioned above, is known as the Maple-leaf cutter. The perfect insect proceeding from it, after its hibernation among the dead leaves on the ground in the pupa state, is a little moth of only a third of an inch in expanse of

wings, belonging to the family of *Tineidæ*, which comprises the smallest forms of the *Lepidoptera*. It was described thirty-five years ago by Dr. Fitch, in his *First Report on the Noxious Insects of New York*, under the name of *Ornix acerifoliella*, where it is recorded as having caused so serious an affection of the maples in the eastern section of New York, in the year 1850, as to make it a common subject of remark. The forest maples were alone affected by it; those isolated in fields and about dwellings entirely escaped. It had been observed for several years (perhaps ten) annually, with the return of the month of May, in numbers in the forests, but at the time of writing (1854) it had nearly disappeared; for two years past not one had been seen, and even its pupæ could not be found on searching among the fallen trees.

Its Subsequent History.

No record is found of later injuries from it in the State of New York. In 1859 Dr. Fitch received examples of the insect with inquiries of its habits, from North Clarendon, Vt., as appears from a communication made by him to the *Country Gentleman* of October sixth of that year. Its ravages at and in the vicinity of Pittsford, Vt., given on page 216, were in the year 1874. Dr. Packard's only acquaintance with the insect seems to be (*loc. cit.*) in maple leaves, and cases illustrating its work received from Vermont — at what time is not stated. Its occurrence in the State of Illinois was observed by Miss Emily A. Smith, on forest maples, during the month of August and thereafter increasingly until the fall of the leaves in autumn.

Its Destructiveness in Canada.

Mr. James Fletcher, Entomologist of the Department of Agriculture of Canada, has given an account of an extraordinary occurrence of this insect in a maple wood adjoining the grounds of the Government House at Ottawa, in September of 1885. The maple trees, for a space of perhaps four acres, had the foliage almost entirely consumed, and the flat, disc-like cases of the larvæ were carpeting the ground, and were also in great numbers on the trunks of the trees. Some beech trees growing among the maples had also been attacked after the leaves of the maple had been devoured. The attack was so severe in the skeletonizing of the leaves that the woods presented a cream-colored hue instead of their usual green.

A similar visitation had been observed by the Rev. T. W. Fyles, of South Quebec, in Missisquoi county, in the year 1881, particularly in maple groves in the village of Sweetsburgh, Quebec. The foliage was so skeletonized that it presented a brown and scorched appearance, as if a hot blast had passed over the woodland. Myriads of the larvæ

in their disc-like covering were to be seen on the leaves and branches of the trees and on the undergrowth. The following season clouds of the perfect insect would rise from the foliage when disturbed by the passers-by.

Elsewhere in Canada — which, from the above accounts, would seem to be the home of this insect, from which it, at times, extends southward into Vermont and New York — it has been observed in the London district by Mr. E. Baynes Reed, who records it (*loc. cit.*) as more or less common every year in that locality, and notably in the year 1872.

Caterpillar and Moth Described.

The larva is described by Dr. Fitch as nearly one-fourth of an inch long at maturity; slender, and of a flattened cylindrical form, soft and contractile, its segments marked by slight, intervening constrictions. It is of a dull white; the head, which is strongly depressed, and the three thoracic segments are pale rusty-brown; an interrupted broad, blackish stripe, more or less distinct, traverses the middle of the back.

The moth measures 0.35 inch ac ss its forewings, which are of a brilliant steel-blue color, or sometimes bluish-green, with a purple reflection, and without spots. The hind wings are pale smoky-brown and translucent, with pale blue and purple reflections and a pale brown fringe. On the crown of the head, between the antennæ is a tuft of erect bright orange hairs. The thorax is brilliant steel-blue, and the abdomen of a dark satiny-brown.

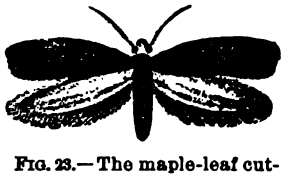

FIG. 23.—The maple-leaf cutter, INCURVARIA ACERIFOLIELLA (after Fitch).

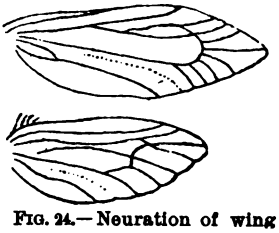

FIG. 24.—Neuration of wing of the maple-leaf cutter.

Figure 23 (after Fitch) represents the moth in enlargement, and Figure 24 (after Clemens) the neuration of its wings.

Remedies.

As the insect pupates within the leaves, and remains in them after their fall during the winter, its numbers may be greatly reduced in maple groves by permitting cattle or sheep to range therein, and attracting them to the more particularly infested trees, if such there are, by feeding salt beneath them, as suggested by Dr. Fitch.

When isolated shade trees are attacked, as they sometimes are (on the authority of Mr. Reed), the depredations may be arrested by spraying with London purple — one pound to 200 gallons of water.

Hæmatobia (Lyperosia) serrata Rob. Desv.

The Cow-horn Fly.

(Ord. DIPTERA: Fam. STOMOXYDÆ.)

Hæmatobia serrata ROB. DESVOIDY: Essai sur les Myodaires, 1830, p. 389, 3.
Hæmatobia serrata. MACQUART: Suites à Buffon, ii, 1835, p. 244.
Lyperosia serrata RONDANI: Dipterologiæ Italicæ Prodomus, v, 1862, p. 231.
Priophora serrata ROB DESV.: Hist. Nat. Dipt., 1863.
Stomoxys cornicola WILLISTON MS.: LINTNER: in Count. Gent. for Oct. 18, 1888, liii, p. 779.
Hæmatobia serrata. LINTNER: in Count. Gent. for Nov. 29, 1888, liii, p. 893.
Hæmatobia cornicola WILLISTON. SMITH: in Count. Gent. for Aug. 8, 1889, liv, p. 591-2 (description, figures, habits, etc.): Bull. F. N. Jer. Agricul. Col. Exp. St., 1889 (habits and remedies).
Hæmatobia cornicola WILLISTON: in Entomolog. Amer. for Sept., 1889, v, p. 180-1 (figure, description and notes).— HOWARD: in Insect Life, ii, 1889, p. 60.
"The Texas fly." LINTNER: in Count. Gent. for Sept. 20, 1888, p. 705; id. for Oct. 11, 1888, p. 759.
"The Buffalo or Texas fly." Pacific Rural Press for Aug. 3, 1889, p. 89 (in Iowa).

Hæmatobia serrata occurs in Europe, in Southern France and in Italy, where it is reported as tormenting cattle. Beyond this, very little, so far as we know, has been written of it and we may therefore infer that it has not been regarded in its native home as a particular pest.

Its introduction into this country must have been of recent date. It seems to have been first noticed in Chester county, Penn., in the year 1886. In the autumn of 1887, the attention of Professor Cope, of Philadelphia, was drawn to the fly, as greatly annoying cattle and congregating in large numbers on and around their horns. My attention was called to it in the summer of 1888, through a communication submitted to me and published in the *Country Gentleman* of September twentieth, as follows:

Farmers in this neighborhood are making quite a time about a small fly that gets on their cows' horns. They say that they bore into the horn and deposit an egg that hatches, and the grub burrows into the head of the cow and produces death. They are putting tar over the cows' heads and horns, which I do not wish to do. They call it the Texas fly. Please answer in your valuable paper if there is any danger, or whether it is all moonshine. H. F. A., *Hamilton Square, N. J.*

Reply was made to the above of ignorance of any insect having the habits above described and a doubt of the existence of such. That an injury of this nature might be inflicted was within the range of possibility, but if the fly existed in Texas, or elsewhere in the United

States, or in other countries, it would have been known long ago to scientists. The story as told, therefore, of the Texas fly, need not be credited, and it does not seem advisable to make the application of tar to protect from injuries which probably do not occur.

The publication of the above called forth the following communication, contained in the *Country Gentleman* of October 11, 1888, which gave us the first definite information regarding the habits of the new insect, and was also accompanied with specimens of the same:

EDS. COUNTRY GENTLEMAN.—The small cow-fly referred to by your correspondent, on page 705, first attracted general attention in Chester county, Penn., in 1886. How long they may have been present in lesser numbers we do not know, but in that year they caused general comment by their habit of congregating on the horns of cattle, seeming at the first glance like a mass of tar, extending some three or four inches on the upper surface of the horn. Examination would soon show that they were not confined to the horns or head, but attacking the animal generally—neglecting, however, the legs and feet, where the ordinary fly is particularly troublesome. They especially feed on the shoulders and at the root of the tail—our cattle generally having a sore spot on the hairless skin on each side of the tail. They are, as will be seen by the sample mailed, about one-half as large as the ordinary fly, and quite like them in appearance. They avoid horses entirely, and appear to have largely reduced the number of their predecessors. They do not bite the milkers as the others did, and their several bites do not appear to annoy the cattle nearly as much as the old ones; but they are much more persistent, and come early in spring, long before "fly-time." For want of a better name, our farmers are calling them Texan flies.

It is generally affirmed that they cling to the cow and bite all night. From my own observations, I doubt their feeding then.

It would be of considerable interest to learn how much of our country the fly has appeared in, and when it was first observed. Your readers can give us the information, no doubt.*

J. L. B.

KENNETT SQUARE, CHESTER CO., PA.

The fly was unknown to me. It was evidently closely allied to our well-known and common biting fly, *Stomoxys calcitrans* (Linn.), which appears in autumn and attacks animals and men, often entering our houses, and from its marked resemblance to the common house fly, not recognized as different until it inflicts a sudden, sharp, stinging bite through the stocking or elsewhere on the leg—seldom on any other part of the body. If captured and examined, the long, slender and projecting proboscis with which the bite is inflicted may be readily seen.

*No one, as yet, has given an earlier date than the above for the first appearance of the fly, nor has its distribution been ascertained.

Upon making inquiry of Dr. S. W. Williston, who is conceded to be the best authority among us on American Diptera, of his knowledge of the insect, reply was made that he had received specimens of it from several sources during the past year, and that it was a new species of *Stomoxys* which he would soon describe under the name of *cornicola*.*

Previous to this, it seems to have excited considerable attention throughout the State of New Jersey during the year 1887, and was accordingly made the subject of inquiry and remark at the Annual Meeting of the State Board of Agriculture held at Trenton on the 3d of February, 1888. The principal statements of interest made, were, that it appeared at different localities about the same time, viz., in the early morning before daylight. It was particularly fond of fastening itself on the udders of the cows, or where the skin of the animal is the thinnest. When the animal is lying down it settles on the thin skin behind the shoulder-blades. It often collected about the horns, and this spot would be covered with its excreta. It followed the cattle into the stall where it annoyed them both in the morning and evening. It had not been seen on horses or mules — only on cattle. Specimens of it had been sent to the Department at Washington, and it was learned from the Entomologist that it had not been seen by him before, and could not at present be named.†

Identical with an European Species.

Although new to all of our entomologists, it did not seem wise to accept it as a species that had long been with us and chanced to have remained undetected until it suddenly developed a new and peculiar habit of annoyance. So many of our more noted insect pests have, through the daily intercommunications of commerce been transferred from Europe to our shores, that it was quite probable that this also had a similar origin — the more so since the Diptera could be so easily carried on shipboard. A number of examples of the fly were therefore obtained and sent to Baron Osten Sacken of Heidelberg, Germany, whose special study of the Diptera during the past forty years, both in this country and in Europe have given him the highest rank among the Dipterologists of the world. He kindly returned answer that the insect, although a true Stomoxyd, and allied to *Stomoxys calcitrans*, was easily distinguishable from it in the following characters: 1. Its smaller size and more uniformly grayish-brown color. 2. Its long palpi, nearly as long as the horny, porrect proboscis. 3. The structure of the hind tarsi in the male, the two long basal joints of which show a

* See *Country Gentleman* of October 18, 1888, p. 779, where the proposed specific name is erroneously given as *cervicola*.

† *Fifteenth Ann. Rept. N. J. State Board of Agriculture*, 1888, p. 163.

triangular projection which makes the edge of the tarsus appear serrate; hence its specific name. It was the *Hæmatobia* (*Lyperosia* Rond.) *serrata* of Rob. Desvoidy.

The determination of the specific name had been made by his friend, Mr. F. Kowarz, to whom some of the specimens were sent, in consideration of his superior knowledge of European Diptera. He had written that "the most careful comparison has not disclosed any differences between the American and the European specimens of this fly."

European Bibliography of the Fly.

Baron Osten Sacken, with his accustomed kindness, also communicated the European bibliography of the insect herewith given, together with the following remarks upon the generic terms employed therein, which will be appreciated by the scientific student:

As there are several other species of *Hæmatobia* in existence, Rondani formed the genus *Lyperosia* (Prodr., etc., i. p. 92, 1856) for those of them which have the arista beset with hairs on the upper side only, and the end of the first longitudinal vein *opposite* the small cross-vein. In the remaining Hæmatobiæ the arista shows some few hairs on the under side also, and the first longitudinal vein reaches *beyond* the small cross-vein.

The genus *Priophora* was proposed by R. Desvoidy (in his posthumous work, Hist. Nat. Dipt., etc., 1863) for *H. serrata*, on account of the structure of the hind tarsi in the male. Robineau [Desvoidy] did not know of Rondani's publication; nevertheless *Priophora* and *Lyperosia* are *not* synonyms, and are based on different characters, viz., *Priophora* on the male hind tarsi, *Lyperosia* on the mode of hairiness of the arista and on the venation; *Priophora*, in Robineau, contains the single species *serrata;* while Rondani's *Lyperosia* contains *serrata* and *irritans*.

Doubt Expressed of its Introduction.

Prof. J. B. Smith, of the New Jersey Agricultural Experiment Station, in a recent publication on the fly (*loc. cit.*), expresses his belief that it is not an introduced species, and that there is no real reason for supposing it to be other than an American form which abnormal circumstances have raised to the rank of a temporary pest. It is but just to Prof. Smith to state that the opinion was expressed, and the MS. name of *H. cornicola* given it by Dr. Williston, accepted without the knowledge of the positive identification of the fly with the *H. serrata* of Europe, from the examples sent by me for comparison, as above stated. It is also learned from Dr. Williston, that his quite recent publication of *Hæmatobia cornicola* new sp., was also made in ignorance of the above determination — since unhesitatingly accepted by him.

The Fly Illustrated.

Those who desire a description of the fly may find it in the *Country Gentleman* or in *Entomologica Americana*, as cited. As preferable to a detailed description for the use of the agriculturist or stock grower, the illustration by Prof. Smith, given in the above places, is herewith presented.

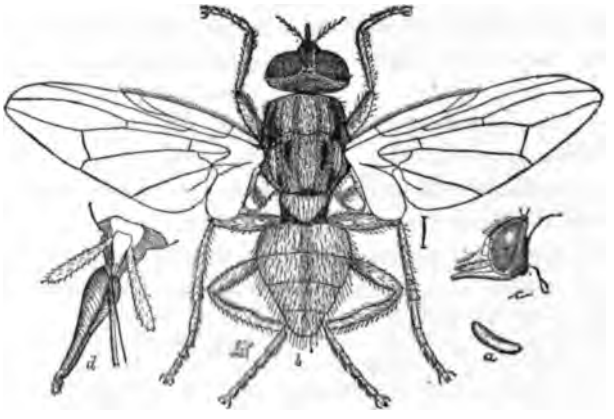

FIG. 25.— The Cow-horn fly, HÆMATOBIA SERRATA: *a*, the egg; *b*, the imago or perfect insect; *c*, head of the same seen from its side, showing the proboscis at rest; *d*, mouth-parts, showing the long palpi and the proboscis with its lancets thrown out.

Life-history and Habits.

The interest excited by the sudden advent in great abundance of a new pest, together with the greatly exaggerated reports of the character and amount of injury it would inflict upon the cattle interests of the country, have drawn the earnest attention of some of our entomologists and others to it, but as yet we are without a published life-history of it. It is now generally known, however, that the fly does not deposit its eggs on the animal, the grubs from which bore into the horns and penetrate the brain, as at first believed, but that it oviposits largely, if not altogether, in fresh cow-droppings.

The egg, of a deep brown color and larger than that of the common house-fly, has been described by Prof. Smith, and Mr. L. A. Howard has given the entire period of development of the insect from the egg through the larval and pupal stages to the perfect fly, as only twelve days. A knowledge of this fact satisfactorily accounts for the rapidity of multiplication of the insect seen after its first appearance in the month of May.

Mr. E. Boder, of Freehold, N. J., who has apparently given close attention to the fly, has kindly furnished me some of his observations, from which I extract:

"In my observation in a pasture-field this morning I found a lot of horn-fly eggs on manure dropped last night and this A. M.— only on droppings that were in the shade. The eggs were scattered over the top and not buried in the manure as those of other cow-flies, and which, I think, prefer the sun."

A number of the eggs thus found were sent me on different occasions, upon their bedding, but they could not be recognized when received, nor were larvæ from them found within. Two other species of *Muscidæ* were obtained from the masses, about fifteen days after reception, but no examples of the horn-fly. Others have experienced the same difficulty in attempts to rear the species.

Some other statements of habits, etc., contained in Mr. Boder's letters, are these:

Not one in fifty of the flies appear to be blood-suckers, judging from their actions by daytime, and, also, by crushing them fresh from the cow. Those that are blood-suckers also bite at night the cattle that are left out all night. For the past month (August), a portion of the flies have come to stall with the cows that are stalled all night.

It may be prejudice, but from my view, our common cow-fly [*Stomoxys calcitrans*], for biting, beats this new pest twenty to one in worrying the cows.

The fly subsists on the loose, soft part of the horn, near the head, and also, apparently, on the hair or dandruff, or both. [We can not imagine what operation of the fly has been mistaken for this feeding, for it is known that its mouth-parts — even of the male, which probably does not subsist on blood — are entirely unfitted for taking other than liquid food].

Heavy rains seem to be unfavorable to the production of the fly — perhaps through destroying its eggs. Ants and beetles of several kinds explore every piece of the droppings favorable, and apparently destroy millions of the maggots.

As these pages are about being handed to the printer, the gratifying information is received from Mr. Howard, of the Entomological Division at Washington, that they have secured full notes of the insect, have traced every stage of its life-history and have had a number of illustrations made, which will be published either in the Annual Report of the Entomologist, or earlier in Insect Life.

The Injury to Cattle.

The nature of the injury caused to cattle, from the attack of this fly, and its extent, has been so ably summarized by Prof. Smith that we copy the following from his paper cited, as best covering our present knowledge on the subject:

When many of these flies are at the cattle, of course the pain caused by the poisoned punctures is almost incessant; the cattle throw their heads about, lash their tails, and in every way try to get rid of their

tormentors. These, on the other hand, congregate at those points where they can not be easily reached, and the cattle are kept in a state of constant excitement. Judge Forsyth writes: "They live on them day and night and never leave them. My cows have shrunk in cream full one-half; the milk will not make but little more than half it did before the flies came." This is the primary injury caused. The cows kept in a constant state of annoyance, become poor and fall off in milk; secondarily, the cow, to get rid of the pests on her horns, and to allay the itching of the punctures at the base, will rub her head and horns against anything convenient to scratch, and inflammation of even a severe character may result — possibly even to the loss of one or both horns. There is no such thing as burrowing into the skin either by the larva or the imago, but the facts, as I have detailed them, are bad enough, since the result is the same, even if common observation has mistaken the actual cause.

Its Distribution.

Thus far the fly has been observed infesting cattle in northern Virginia, Maryland, Delaware, Pennsylvania, and New Jersey. I have not heard of its presence in New York, but in all probability it is to be found in some of the southeastern counties of the State.

The statement of its presence in Iowa, made in the *Pacific Rural Press* of August 3, 1889, and of the injuries inflicted by it, needs verification — the latter, to the extent stated, of course, can not be accepted.

The Buffalo fly, or Texan fly, an insect but half as large as the common house-fly, has been killing off the cattle in southeastern Iowa for some weeks past. A dispatch from Burlington states that the pests have caused the loss of several herds in that vicinity. They attack the cows at the base of the horns, and after a few days the horns come off. In another day the cow dies. Many beasts are suffering in a similar manner, and there has not been any remedy discovered that will effectually destroy the fly.

Preventives and Remedies.

It is believed that this new pest will not prove to be a difficult insect to control. There are several applications much less objectionable than tar that can be used for keeping the flies from alighting on the animal, or at least from remaining long enough to puncture the skin or be an annoyance otherwise. Crude kerosene oil, it is claimed, will accomplish this, without harm to the animal. The Division of Entomology at Washington has recommended the following: (1) Fish-oil and fine tar with a little sulphur added; (2) tobacco dust when the skin is not broken; (3) tallow and a small amount of carbolic acid.

Some oil mixed with "soluble phenyle" or almost any one of the popular "sheep-dips," properly applied, should prove efficient.

Professor Smith recommends very highly a tobacco-dust preparation known as X. O. Dust and manufactured by the Insecticide Manufacturing Co., at 10 East Camden street, Baltimore, as safe in use and prompt and efficient in action. He asserts: "If thoroughly applied so as to get the hair well dusted, no *Stomoxys* or *Hæmatobia* can stand it long enough to puncture the skin of the cattle. It would mean death to them. The powder does not lose strength by exposure."

But the best way to meet the insect, would, in all probability, be to destroy it in its earlier stages by applying lime to the droppings. If this be done on successive mornings, the eggs would be killed before their hatching and entering the manure as maggots. The suggestion of Mr. Howard is therefore valuable — to prevent the insect surviving the winter by liming the dung in the autumn where the cattle frequently stand at night. It being here that the eggs are deposited and where by far the larger number of the insects will probably hibernate, if the liming be done so thoroughly as to be carried or trodden into the droppings, it certainly should destroy all the horn-flies in its early stages that might otherwise survive the winter.

Dynastes Tityus (Linn.).

The Spotted Horn-bug.

(Ord. Coleoptera: Fam. Scarabæidæ.)

Linnæus: Syst. Nat., ii, 1767, p. 542, No. 5 (*Scarabœus Tityus*).
Fabricius: Syst. Ent., viii, 1775, p. 18; Sp. Ins., i, 1781, p. 8, No. 23 (*Scarabœus*); Ent. Syst., Pt. i, 1792, p. 10, No. 25; Syst. Eleuth., i, 1801, p. 10, No. 28 (*Geotrypes*).
Say: Amer. Entomol., i, 1824, p. 8; Compl. Writ., i, 1883, p. 8, pl. 4 (*Scarabœus*).
Fitch: 3d Rept. Ins. N. Y. (3d–5th Repts.), 1859, p. 49, No. 72.
Glover: in Rept. Commis. Agricul. for 1868, p. 89, f. 80.
Riley: in Amer. Entomol., ii, 1870, p. 374, f. 224.
Horn: in Trans. Amer. Ent. Soc., iii, 1870, p. 78 (var. *Grantii*).
LeBaron: 4th Rept. Ins. Ill., 1874, p. 84, f. 38.
Thomas: 6th Rept. Ins. Ill. [1877], p. 96, f. 7 (description).
Lintner: in Count. Gent., xlvii, 1882, p. 645; in id., i, 1885, p. 623.
Dimmock: in Cassino's Stand. Nat. Hist., ii, 1884, p. 368, f. 427.
Johnson: in Bull. No. 4, Divis. Entomol., U. S. Dept. Agricul., 1884, p. 78.
Henshaw: List Coleop. N. Amer., 1885, p. 93, No. 5886.
Smith: in Proc. Ent. Soc. Wash., i, 1888, p. 54 (its odor).
Atkinson: Bull. No. 4, Agricul. Exp. St. Univ. S. Car., 1889, p. 87 (its odor).
Webster: in Insect Life, ii, 1889, p. 89 (in Indiana).

The following communication, under date of August second, from a gentleman at Perrowville, Va., accompanied specimens of the above-named beetle. The reply made thereto in the *Country Gentleman* of

August 17, 1882, has been rewritten and extended in the present notice, in consideration of the particular interest attending the insect.

I send by mail to-day a box containing several specimens of a hideous and most offensive beetle which has recently begun its ravages in the ash trees on my lawn. Will you please tell me its name and character, and how to free our trees from its presence. The odor from these beetles is so offensive at night that it is disagreeable to sit in the open air. I learn that they also occur on the forest trees in our vicinity.

The beetle is the *Dynastes Tityus* of Linnæus, known under the popular names of "the spotted-horn-bug" and the "rhinoceros beetle" — each having reference to the large horns with which the male is armed — these horns being, as in many other species of Coleoptera, as notably in "the stag-beetle," a sexual feature.

An Odorous Insect.

The family of *Scarabæidæ*, to which this beetle belongs, contains many species which are noted for the disagreeable odor that they emit, but none have the penetration and pungency of this. Where a large number are congregated, the atmosphere in their vicinity would readily become quite unpleasant to the nostrils, for even the dead bodies of the half-dozen sent me, although occupying a place, as I am writing, upon an open piazza at a distance of several yards from me, and after having been exposed to the air throughout the night, have rendered their vicinity quite intolerable to some of the unscientific members of my family who have been sitting with me.

The remarkable offensiveness of this insect has often been commented on. Among other notices of it are the following:

Mr. J. B. Smith, in a paper read before the Entomological Society of Washington, September 2, 1886, on the peculiar odor emitted by these beetles, stated that they had during the season developed into a veritable pest. In two States, Virginia and Tennessee, they had been locally so abundant as to saturate the air with the penetrating stench. The local boards of health, especially that at Memphis, Tenn., disinfected all sorts of foul and suspected localities without success, and only by accident was the true source of the smell at last discovered.

Prof. G. F. Atkinson, Entomologist of the Agricultural Experiment Station of South Carolina, states in Bulletin No. 4 of the station for January 4, 1889: "In the summer of 1886 the beetle was so plentiful, feeding on the leaves of the ash in Raleigh, N. C., as to cause a disagreeable odor, which pervaded nearly the whole city. For some time it was thought to be due to uncleanliness in certain parts of the city, but was eventually traced to these beetles."

Description.

The beetle, although "horrid" in the eyes of the gentleman communicating it, is, to the entomologist, from its size, form, and ornamentation, a beautiful and attractive specimen of the Coleoptera. It is, perhaps, the largest of our United States beetles. The maximum size of the males before me (not the largest that occurs) is two and one-half inches in length (three and one-half inches with legs extended), one and one-tenth inch across the abdomen, and eight-tenths of an inch in thickness of body. The female has the general form of the much smaller grapevine beetle, *Pelidnota punctata*. The male has quite a different aspect, being armed anteriorly with two stout black horns of a half-inch or more in length, of which the upper is a straight projection of the anterior part of the thorax, curving slightly toward its notched tip, and bearing stiff yellow hairs beneath; the lower one on the crown of the head curves upward to meet the other. On each side of, and near to, the thoracic horn is a black, short, sharp-pointed horn or spine. The thorax and wing-covers are of a pale olive-brown, the latter dotted irregularly with black spots of various sizes and shapes, of which some may be ocellated. Beneath, the abdomen is black. The legs are shining black, strong, and armed with stout spines and bristles. Fig. 26 represents the male as seen from above, and Fig. 27 as seen from the side.

Fig. 26.—The Rhinoceros beetle, Dynastes Tityus, male.

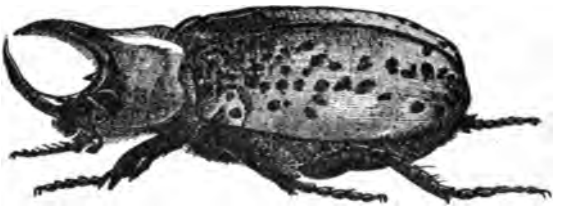

Fig. 27.—Side view of the Rhinoceros beetle.

Variation.—Much variation is presented in the colors and markings of these beetles, and particularly in the females. One example in my collection has the thorax black, while in another both the thorax and the wing-covers are very dark brown. A male before me has the

thorax of the normal color, while the elytra are dark brown, slightly mottled with paler brown. The females have the thorax delicately punctured (smooth in the other sex), with the wing-covers strongly punctured.

Distribution.

This beetle is quite abundant locally, at times, in most of the Southern States. To the west of the Mississippi, it occurs in Arizona, Kansas, Missouri, etc. It is found in Pennsylvania, but rarely. Dr. Fitch, in his *Third Report on the Insects of New York*, notices it as infesting the cherry (presumably in New York), but if taken within the State, it must have been in its southern portions.

Food of the Insect.

This insect has not been numbered among our insect pests, since its food has generally been supposed to be confined to decaying vegetable matter. The larva, probably, subsists only on material of this nature, which is a fortunate circumstance, for from its large size, attaining, it is said, four inches in length and a large diameter, it would be capable of inflicting most serious injury if it burrowed within the roots or trunks of living trees.

It has frequently been found (either as larva or imago) in cavities of dead or dying trees, as the cherry, willow, oak, etc., buried within the black vegetable material there accumulated.

The beetle, however, seems capable of injuries of considerable importance. Mr. J. W. Murrell, of Perrowville, Va., has informed me that, on the thirtieth of June, numbers of the beetle were feeding on the tender shoots of the spring growth of ash trees, causing the leaves to fall and cover the ground as if a frost had passed over them.

Request made of Mr. Murrell for additional observations on the feeding and other habits of the beetle was promptly complied with, in the following interesting communication received from his son, Mr. G. E. Murrell, of Coffe, Va.

Among the trees on my father's lawn are twenty of ash, to six of which my observations have been mostly directed, as they have been infested yearly for some time past. These are in different parts of the lawn, between other ash trees, and are the same in health and otherwise as those not attacked. I have first seen the beetles coming out of the ground at the roots of the trees, with one exception, which was four years ago, when I dug them out of a decayed fork of a mulberry, on which no trace of them has since been seen.

When feeding on the ash, they place themselves longitudinally on a smooth limb, and, rising to the full extent of their legs, move their entire body backward and forward like a plane, using several chisel-like projections on the under-side of the head for cutting, stopping the

motion as soon as the alburnum is reached, and never using their horns, so far as I can see, except for fighting. They breed below ground, to the best of my observation.

A neighbor says that he has been troubled with them on his tobacco, to which they are extremely fatal — no plant once attacked ever surviving.

The method of feeding on the bark of the ash, as above given, is an interesting item in the habits of the beetle, but it leaves us desirous of further information as to whether it prefers the bark to the leaves, and if it consumes, harmlessly, only the outer bark, or injuriously, also, the alburnum beneath. Does the larva, in its growth within the ground, subsist only on decaying vegetable matter, or in part on the rootlets of the trees?

The nature of the attack on tobacco — in what manner and to what extent it feeds upon it — would also be of much interest toward a fuller knowledge of this large insect.

Remedies.

When attacking, to a harmful extent, shade or ornamental trees, or when the offensive odor becomes intolerable, the beetles may be destroyed by the application of an arsenite to the foliage, or by jarring or beating them from the branches and dropping them in hot water.

Oberea bimaculata (Oliv.).

The Raspberry-cane Girdler.

(Ord. COLEOPTERA: Fam. CERAMBYCIDÆ.)

Saperda tripunctata FABRICIUS: Ent. Syst., i, pt. ii, 1792, p. 310, No. 15; Syst. Eleuth., ii, 1801, p. 321.

Saperda bimaculata OLIVIER: Entomologie, iv, 1795, 68, p. 21, pl. 4, f. 43.

Saperda affinis HARRIS: Rept. Ins. Mass., 1841, p. 91.

Oberea tripunctata HALDEMAN: in Trans. Amer. Philosoph. Soc., x, 1847, p. 57.

Oberea perspicillata HALDEMAN: in loc. cit. sup., p. 57.

Oberea tripunctata. LECONTE: in Journ. Acad. Nat. Sci. Phila., 1852, p. 153.

Oberea basalis LECONTE: in loc. cit. sup., p. 153.

Saperda (Oberea) tripunctata HARRIS: Ins. New Engl., 1852, p. 100; Ins. Inj. Veg., 1862, p. 114, f. 51.

Saperda tripunctata. EMMONS: in Nat. Hist. N.Y.—Agricul., v, 1854, p. 122, pl. 16, f. 7.

Oberea tripunctata. GLOVER: in Rept. Comm. Agricul. for 1863, p. 576.

Oberea tripunctata. SAUNDERS: in Rept. Ent. Soc. Ont. for 1873, p. 8-9; Ins. Inj. Fruits, 1883, p. 305-6, f. 315 (*O. bimaculata*).

Oberea tripunctata. LINTNER: in Count. Gent., xxxix, 1874, p. 487.

Oberea perspicillata. RILEY: 6th Rept. Ins. Mo., 1874, p. 111 (quotes Provancher).
Oberea tripunctata. PROVANCHER: Pet. Faun. Entomolog. Can., 1877, p. 636.
Oberea bimaculata. HORN: in Trans. Amer. Ent. Soc., vii, 1878, pp. 46, 48.
Oberea bimaculata. HENSHAW: List Coleop. N. Amer., 1885, p. 104, No. 6496.

An insect attack on the new shoots of the raspberry which is often the occasion of inquiry, is that which attends the oviposition of the raspberry-cane borer. The following is received from Potsdam, N. Y.:

You will find herewith a small vial containing an insect and three pieces of canes of Brinckle's Orange raspberry. You will see the two rings that are made in the canes between which an egg is deposited — usually in the center, but not always. Can you give me the name of the creature which is causing so much mischief; and what shall we do to prevent the destruction of our raspberries?

Synonymy of the Insect.

The author of the mischief above described is a longicorn beetle having the scientific name of *Oberea bimaculata.* As may be seen above, it was given the name of *Saperda bimaculata* by Olivier in 1795. It had been previously named by Fabricius as *tripunctata,* from the three black spots that its thorax frequently bears, and it was for a long time, and until quite recently, known under the Fabrician name. When it was found, however, that the name had been preoccupied in the same genus by a species by Swederus occurring also in the United States, it was necessarily abandoned for that given it somewhat later by Olivier. Of the other specific names, that bestowed on it by Dr. LeConte, *basilis,* was based on examples in which the entire basal margin of the thorax is black; and *perspicillata* of Haldeman, on smaller forms showing some other features not of specific importance.

Description of the Beetle.

The beetle is of a slender cylindrical form, about a half-inch in length, with delicate antennæ nearly as long as the body and tapering slightly toward the tip. It is of a deep black color except the forepart of the breast and top of the thorax which are rusty-yellow. There are two black elevated dots on the middle of the thorax (sometimes absent) and a third dot (usually) on its hinder border. The wing-covers are closely punctured in the rows, and irregularly on the sides and tips — each of the latter slightly notched and ending in two little points.

FIG. 28. — The raspberry-cane borer, OBEREA BIMACULATA.

The Cane-girdling.

The two rings referred to in the communication consist of closely placed punctures which are made by the mandibles of the beetle around the stem not far from its tip; the distance between the rings ranges from half an inch to one inch. As soon as these punctures are made — usually in the month of June — the portion of the cane above the upper girdling commences to wither and droop, to shrivel and die, when it is easily broken off by the wind.

It is supposed that the purpose served by the girdling is the arrest of the circulation of the cane in the portion thus treated, to the extent that the tender egg deposited therein may not be crushed by the vigorous and rapid growth of the tips at just this season. A number of insects are apparently endued with an instinct that leads them to resort to some similar method for the preservation of their eggs in cases where a provision of the kind seems to be needed.

Summary of Life-history.

The egg, which is deposited by the beetle in the cane previous to the girdling, hatches in a few days and the grub therefrom burrows downward into the cane, feeding meanwhile upon the pith. It may be found full-grown a few inches down the stem about the first of September. It passes the winter within the stem (according to Riley, in the root beneath the surface of the ground), to emerge therefrom as the perfect beetle the following June.

The beetle unquestionably prefers the garden raspberry for oviposition, yet it is also to be found at times on the more tender canes of the blackberry. Professor Riley has observed its operations in cottonwood [*Populus monilifera*], and identified its oviposition in the twigs of persimmon [*Diospyros Virginiana*] from Saint Augustine, Florida.* A closely related species, *Oberea Schaumii*, oviposits in sassafras, according to Mr. Schwarz.

The *Oberea perspicillata* of Walsh and other writers is our raspberry-cane borer under a name given it by Haldeman in 1847, as cited.

Remedy.

It is seldom that this insect appears in sufficient number to be the occasion of serious injury. Its multiplication may be prevented by going over the bushes at intervals of a few days, during the period of its oviposition when the bent and wilted tips at once disclose the attack, and breaking off the egg-bearing tips at the lower ring. If these tips are destroyed, the unhatched eggs or the newly hatched larvæ will be destroyed with them, the larva not having at this time passed downward into the cane.

* *Bulletin No.* 12, *Div. of Entomology, U. S. Dept. Agricul.*, 1886, p. 34.

Galeruca xanthomelæna (Schrank).

The Elm-leaf Beetle.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

LINNÆUS: Syst. Nat., ii, 1767, p. 600, No. 101 (*Chrysomela Calmariensis.*)

FABRICIUS: Syst. Ent., 1775, p. 119, No. 4 (*Crioceris Calmariensis*); Spec. Ins., i, 1781, p. 150, No. 6; Mant. Ins., i, 1787, p. 87, No. 7; Ent. Syst., i, pt. ii, 1792, p. 23, No. 46 (*Galleruca Calmariensis*).

SCHRANK: Enumeratio Insectorum Austriæ indigenorum, 1781, p. 78.

OLIVIER: Encyc. Method.—Hist. Nat. Ins., vi, 1791, p. 589 (as *Galeruca calmariensis*).

WESTWOOD: Introduc. Classif. Ins., 1839, p. 382 (destructiveness in Sevres).

HARRIS: Treat. Ins. N. Eng., 1852, p. 109; Ins. Inj. Veg., 1862, p. 124 (*Galeruca Cal.*).

EMMONS: in Nat. Hist. N. Y.—Agricul., iv, 1854, p. 134, pl. 12, f. 12.

FITCH: in Trans. N. Y. St. Agr. Soc. for 1858, xviii, 1859, p. 842-3; 3d-5th Repts. Ins. N. Y. (5th Rept.), 1859, p. 62-3.

LECONTE: in Proc. Acad. Nat. Sci. Phil. for 1865, p. 218 (features and references).

GLOVER: in Rept. Commis. Agr. for 1867, p. 62 (br. ref. and fig.); id. for 1870, p. 73.

RATHVON: in Field and Forest, ii. 1876, pp. 96-98 (at Lancaster, Pa.).

RILEY: in Rept. Comm. Agricul. for 1878, p. 245 (br. ref.); in Amer. Entomol., iii, 1880, p. 291 (natural history, enemies, etc.); in Ann. Rept. Comm. Agricul. for 1883, pp. 159-170, pl. 12, f. 3 (full account); same, repub. as Bull. No. 6, U. S. Dept. Agricul., Divis. of Ent., 1885; same, in Bull. No. 10 id., 1887, pp. 8-22, figs. 1-6.

FULLER: in Amer. Entomol., iii, 1880, p. 3 (at Newburgh, N. Y.).

LOCKWOOD: in Amer. Nat., xv, 1881, pp. 242-244 (hibernation); in Bull. No. 4, U. S. Dept. Agr., Div. Entomol., 1884, p. 90 (ravages at Freehold, N. J.).

PACKARD: Ins. Inj. For.-Sh. Trees, in Bull. No. 7, U. S. Ent. Commis., 1881, p. 64 (brief description).

LINTNER: in Count. Gent., xlvii, 1882, p. 805; id., l. 1885, p. 841 (remedies, etc.); in Canad. Entomol., xvi, 1884, p. 183 (reference); in Count. Gent., li, 1886, p. 409 (bibliography, etc.): lii, 1887, pp. 421, 565, 695 (spraying for); 4th Rept. Ins. N. Y., 1888, pp. 15, 143, 161, fig. 59 (extension of range).

VAN WAGENEN: in Canad. Entomol., xv, 1883, p. 160 (abundance at Cold Spring, N. Y.).

CLARKSON: in Canad. Entomol., xvi, 1884, p. 124 (at Flatbush, L. I.).

HENSHAW: in Cassino's Stand. Nat. Hist., ii, 1884, p. 316 (its enemies, etc.); List Coleop. N. Amer., 1885, p. 111, No. 6912.

COOK: in Rur. N. Yorker, xlv, 1886, p. 577 (general notice).

DYAR: in Insect Life, i, 1889, p. 285 (at Poughkeepsie).

This destructive insect pest, which within the last few years has extended its ravages into the State of New York, entering it from the south and spreading northward with a steady progress that threatens to carry it to the northern borders of the State, and even beyond, is one of the many injurious species which Europe has contributed to

us. Its great destructiveness wherever it has established itself among us, is one of the many attestations to the often-made statement, that by far the larger number of our more injurious insect pests have been introduced from Europe.

Belongs to the Chrysomelidæ.

It belongs to the *Chrysomelidæ*, that large family of very bad reputation on account of their leaf-eating habits. The beetle is a small, yellow-legged, brown insect, having a broad dull-black stripe

FIG. 29.— The Elm-leaf Beetle, GALERUCA XANTHOMELÆNA, in its different stages.

on each wing-cover toward its outer margin, and three black spots upon the ochreous thorax. In size and general appearance it resembles another well-known member of the family — the striped cucumber beetle, *Diabrotica vittata* (Fabr.). The insect has been so often described in its egg, larval and perfect stages in the Reports and Bulletins of the Entomological Division of the Department of Agriculture, that it does not seem desirable to repeat the details here. Those who may desire detailed descriptions for the purpose of identification or for scientific use, are referred to these publications or to some other of those included in the bibliographical list accompanying this notice.

The figure above given, illustrative of the insect in its several stages, which was presented in our fourth report and is herewith

repeated, should suffice for its recognition when met with upon the elm. In it, *a*, shows the eggs as they are deposited in clusters on the leaf; *b*, the larvæ; *c*, the beetle in natural size; *e*, the eggs enlarged; *f*, their sculpture under a high magnifying power; *g*, the larva in about twice its natural size; *h*, a side view of the segment of the larva; *i*, dorsal view of the same; *j* and *k*, the pupa and the beetle enlarged; *l*, a portion of the wing-cover of the beetle enlarged.

Its European Reputation.

This species has long been known as, at times, quite injurious to the foliage of elms in Europe, but it nowhere appears to have occasioned even an approach to the amount of harm that it has in this country. Linnæus wrote of it over a century ago, in 1767, and named it *Chrysomela Calmariensis*, from its occurrence in Calmaria, a small sea-port town in Sweden.

Introduction in the United States.

It was introduced in this country, according to Glover, as early as the year 1837, but probably several years earlier than this, for it is recorded that in 1838 and 1839, elms in Baltimore and the vicinity were entirely stripped of their leaves in midsummer, and when new leaves had again put forth, these were also destroyed by a second brood of the grubs. Such a degree of multiplication could not have taken place in less time than six or eight years.

Its Ravages.

It has proved very destructive in the District of Columbia, in various portions of New Jersey, and in Pennsylvania. Later, it made its appearance upon the elms in the State of New York, and has wrought great havoc among them.

In 1879, it appeared in immense numbers at Newburgh, N. Y., and almost entirely stripped the foliage from the elms that it attacked. (*American Entomologist*, iii, 1880, p. 3.)

The *New York Daily Tribune*, of July 8, 1884, contained the following picture of the destructions caused by this insect on Long Island:

WORK OF ELM-TREE BEETLES.— Flushing, L. I., is suffering from an insect plague which bids fair to mar the renowned arborial beauties of the village. A few days ago it was noticed that the leaves on several stately trees in Main street were withering. A more careful examination resulted in the discovery that the trees were covered from trunk to topmost branch with little worms about half an inch long. On the ground under the trees were thousands of dead insects which had been blown off and trodden upon by pedestrians, making a most disgusting sight. All the trees in every part of the village are being

slowly ruined by these insects. They are what are known as elm-tree beetles, but they do not confine their presence to elm trees. A number of attempts have been made to destroy them, but without success. It is said that in a communication sent to the Commissioner of Agriculture in Washington last year by a distinguished naturalist, he gave it as the result of his experiments that there was no means of exterminating the beetles. All sorts of insect powders have been used by the residents, but in vain. The village streets present such a plague-stricken appearance that the trustees will probably order some of the trees to be cut down to prevent the pestilence from spreading.

Mr. James Angus has written me of the ravages of the insect as observed by him near Throggs Neck, Westchester county, N. Y., on the 24th of August, 1883. A row of elm trees bordering the road had been entirely defoliated by it. "Incredible as it may seem, there was not a green leaf on any of the trees, except that upon some limbs a second growth had commenced. The leaves had been attacked rose-slug fashion, and every tree looked as badly as the worst slug-eaten rose-bush that I had ever seen." Writing the following year, under date of May thirty-first, he stated: "I visited to-day the place where the insect was so destructive last year, and found that the elms were eaten far worse than ever before. A gardener informed me that the leaves had been stripped three times during the preceding year. He showed me two trees that had been killed, and others of which most of the outer limbs were dead."

Life-history, as Given by Glover.

The habits and transformations of this insect were concisely and correctly given, and with such a degree of fullness as to leave but little to be added, by Mr. Glover, Entomologist of the U. S. Department of Agriculture, in the *Report of the Commissioner of Agriculture* for the year 1867 (pp. 62–63, with figures). We therefore quote the following from the report named:

The insect deposits its eggs in clusters upon the leaves, the worms or larvæ from which are hatched out in a few days, and immediately commence to feed upon the parenchyma or soft pulpy substance of the leaf, at first making merely small blotches, but eventually, as they increase in size, destroying the whole leaf, leaving only the harder part, such as the midribs and network of veins untouched, thus causing the leaves to turn brown and wither, until the whole tree assumes the appearance of having been scorched by fire. These worms, when fully grown and ready to change to pupæ, not being able to descend by means of a silken thread, like the real caterpillar, crawl down the trunk to the ground; and soon casting their larva skin, change into pupæ on or near the surface of the earth, at the foot of the tree they have despoiled. Some of the worms, however, conceal themselves in

fissures of the bark, where they undergo their transformations into the perfect beetle. These last, however, are few, and bear no comparison with the multitudes of the pupæ which will be found on the damp ground, motionless, helpless, and appearing like grains of wheat accidentally fallen near the tree. After becoming pupæ, in a few days the skin of the back splits open, and the perfect insect crawls forth, furnished with wings, by means of which it is enabled to fly to other trees to deposit its eggs, thus spreading the nuisance to every elm in the neighborhood, or it may ascend the same tree and lay the eggs for the second generation, which destroys the second crop of leaves, frequently so enfeebling the already exhausted tree that it is unable to recover, and eventually dies.

Hibernation of the Beetle.

To the above comprehensive account of Mr. Glover may be added a few additional observations on the life-history of the insect for the benefit of those who may desire as full a history as may be given, in order that they may be the better prepared to meet it in its several stages of transformation.

The insect hibernates in the beetle stage. Members of the last brood (in the State of New York we have two broods a year *) — those that have survived the dangers to which they are exposed — quite early in the season (time not definitely known) seek such sheltered places as may offer them fitting quarters for their winter's sleep. Many enter out-buildings and dwellings for their hibernation, for each spring examples of the beetle, found within doors, and usually in unoccupied apartments, are sent for name and other information, their numbers having drawn attention to them as unknown guests. Mr. Angus, of West Farms, New York, has informed me that a neighbor, whose house was overtopped with two large elms, and had been closed for some time during the summer, upon his return, found the beetle in large numbers lying about everywhere. They had entered the house through the crevices in the shingled roof, and through the chimneys.

The time of the emergence of the beetle from its winter's retreat will vary, of course, with the degree of forwardness of vegetation, but it will be as early as the leaves of the elms are in condition to receive the eggs. On the 24th of April, 1884, Mr. Angus wrote me that it was then first making its appearance in the garret of his house.

* Although this has been generally accepted, Rev. Mr. Hulst and Prof. J. B. Smith, from careful observations made on the insect, as entomologists of the New Jersey Agricultural College Experiment Station, have reached the positive conclusion that for the last two years, at least, there has been but a single annual brood in that State. There may be, they think, a second brood in Washington, but not in New Jersey and to the northward.

A week later, he could send me any number for examination if desired. Writing again on the twenty-eighth inst., he stated, "the garrets of all the houses in the neighborhood where there are elms are full of them."

Oviposition.

It appears that both sexes hibernate, and that their union takes place in the spring, after they have flown to the elms and fed to a noticable degree on the new foliage. Leaves quite badly eaten by the hibernating beetles have been sent to me from Mr. Angus on the twenty-third of May, and on the thirty-first the beetles were reported as copulating and the females rapidly laying their eggs.

Pupation.

The pupation occurs in July. On the ninth of that month Mr. Angus wrote that the larvæ were then pupating in "handfuls" in the crevices of the bark at West Farms. A moderate amount of shelter satisfies the larva, and it accordingly assumes its pupal state under any convenient crevice offered it as between the base of the tree and the ground surrounding it, in crevices between the bricks of a sidewalk, beneath stones or any other object lying on the ground. The beetles make their reappearance after a very brief pupation, rarely exceeding ten days.* Riley has recorded pupation at Washington on July twenty-ninth, which may have been of the third brood.

Remedies.

The most effectual remedy for the ravages of this insect is believed to be spraying the foliage of the infested elms with Paris green or London purple in water. Of these, London purple has been found, through careful experiments made, to answer the purpose the better. Its efficiency will of course depend upon its method of application — the apparatus used, the liquid and the time applied. A suitable force-pump is essential to success. It should have sufficient power to carry the liquid to a good distance and distribute it over a broad area. The nozzle for its distribution should be an atomizer, or the finest of the "Nixon nozzles," made at Dayton, O., or one of the several "graduating spray nozzles" which are in market. The nearer the spray can be made to approach a mist the more effectually will it be spread over the foliage, with the least expenditure of material and with the least injury to the leaves.

If the spray is to be applied to tall and large trees, from the ground or from a wagon, a long rubber hose will be needed having the

*See foot-note on preceding page for qualification of this statement.

nozzle at its end, and tied, for convenience of elevation, to a long bamboo or other light rod. If the highest portion of the tree may not be reached in this manner, a portable spraying apparatus holding four or five gallons, such as is advertised and illustrated in some of the agricultural journals, may be strapped upon the back, and, ascending the tree with a ladder, the spray distributed from its principal limbs.

The proportion of London purple to be used would be one pound to 200 gallons of water. To the above eight quarts of flour might be advantageously added, the effect of which would be to cause the arsenite to adhere better to the leaves and prolong its usefulness.

It is quite important that the spraying should be done early — even before the first traces of injury to the foliage are discovered — as soon as examination shows that the eggs of the beetle are being deposited on the leaves, usually on the under side. They can readily be seen, as they are of a yellow color, oblong-oval in form, and placed on end — sometimes but two or three together, but more often in clusters of from ten to twenty. By early spraying, a less strength of the arsenite is needed to poison the young larva as soon as it hatches from the egg, and the foliage is less liable to sustain injury, as there will be at the time no eaten and raw edges of the leaves to absorb the poison rapidly, and thereby causing greater harm.

If the spraying be properly done at the right time, it should not be necessary to repeat it, unless a heavy rain occurs very soon thereafter. If the foliage shows continued depredations, a second spraying should follow in ten days or a fortnight.

Sulphur for the Elm Beetle.*

W. H. Dodd, of Orange, N. J., says that he has demonstrated to his satisfaction that the annual attack of the elm beetle upon elm trees in this country can be thwarted by an extremely simple and inexpensive process. He addressed a meeting of interested citizens in Bloomfield on Tuesday night, and described the plan which he used last year, not only upon a large elm, but upon fruit trees which were infested with insect pests of various kinds. He says that in the early spring he bores one-inch auger holes, five inches apart and in a circle around the trunk of the tree, about eighteen inches from the ground, taking care that the holes do not penetrate beyond the sap-wood of the tree. Then he fills the holes with flowers of sulphur or powdered brimstone, and loosely plugs them up. He says that the plan worked to perfection last year. His idea seemed to be that the sap took up the sulphur and carried it into the leaves, making them distasteful to the worms which hatch out on the under side of the leaves from the eggs deposited there by the beetles. The plan involved little trouble or expense.—*New York Sun.*

* Communicated, by request, to the *Country Gentleman* of March 15, 1888.

Repeated experiments have failed to show any benefit from the use of the above reputed remedy for insect attack on the foliage of fruit or other trees. It seems to have been first announced sixty-six years ago in the *Memoirs of the* [old] *New York Board of Agriculture* (vol. ii, page 250, by George Webster, of Albany, who, after having bored holes six inches deep in his infested trees, which he filled with sulphur and tightly plugged, found that all the caterpillars disappeared within a day or two thereafter. Others who tried the experiment had the same result. This was, perhaps naturally, ascribed to the sulphur, when, in fact, the larvæ had matured and left the trees to find suitable places for pupation.

Mr. Dodd, the latest propagator of the old remedy, claims that the sap takes up the sulphur, carries it into the leaves and makes them distasteful for food. This can not be true. Sulphur can not enter into circulation, unless it be first dissolved, and we know that it is not dissolvable by the sap of plants or trees. Mr. Isaac Wicks, of New York, having placed a quantity in some peach trees as a remedy for the yellows, on cutting up the trees five years thereafter, found it still remaining in the cavities in its original condition (*Practical Entomologist*, i, 1865, p. 125).

Nor is there any reason to believe that if the sulphur could be carried into the sap, the leaves would thereby become distasteful or injurious to the caterpillars. Among the various articles experimented with in France in search of some remedy against that terrible scourge of the vineyards, Phylloxera, sulphur was tested, but without any effect either upon the leaf or root insects, although these are almost microscopic and exceedingly delicate creatures.

Experiments made by Dr. Fitch prove conclusively that sulphur is not injurious to the apple-tree tent-caterpillar. A limb of a wild cherry tree having on it a nest of these caterpillars which were only one-fourth of an inch long, was cut off and placed in a cup of sulphur slightly moistened with water — a more severe test than if the material had been inserted in the branch. A limb containing another nest was placed beside it in a cup with water only. At the end of nine days the caterpillars of the last-named nest measured four-tenths of an inch long, while the others had grown to double the size, measuring from 0.8 to 0.85 inch. The experiment seemed to show that so far from the sulphur having been injurious to them, it had rendered them more healthy and robust, and accelerated their growth. (*First and Second Reports on the Insects of New York*, 1856, p. 203.)

It seems a great pity that something as simple as the "sulphur cure" can not be found available against the elm-leaf beetle, but until such a discovery shall be made, we shall have to hold fast to the well-tested and efficient method of spraying with Paris green or London purple, with a suitable force-pump, and a sufficient length of hose furnished with an atomizing nozzle; or, later, to cage the mature larvæ for destruction in a box, tarred within and on the bottom, placed around the tree trunk, when they descend the tree for pupation in the ground.

The Box Remedy.

The box, above mentioned, was suggested by Mr. Glover, in his Annual Report as Entomologist to the U. S. Department of Agriculture for the year 1867:

Place around each tree a low open box or frame about a foot or eighteen inches in height, at about the same distance from the main trunk, its lower part sunk four or five inches below the surface of the soil, the top capped with strips of bright tin sloping inwards and projecting on both sides like the eaves of a house, and the upper half of the inside boards painted every morning with coal tar or some other viscid substance. The earth within should be covered with cement. It being the habit of the larvæ when full grown to crawl down the trunk of the tree, they would, upon their descent, be imprisoned within the frames, being unable to escape either by entering the ground, or crawling outside over the tar and the projecting tin. They would therefore be compelled to change to pupæ within the frames, where they could at any time easily be killed by hot water or otherwise, by thousands. The frames should be made so as to be readily taken apart and laid aside at the close of the attack, until they are again needed.

Mr. Glover remarks that the same box might also be used for preventing the female canker worm, *Anisopteryx vernata* (Peck) from ascending the elms and fruit trees for the deposit of her eggs; but in that case, the tar should be applied to the outside of the box.

Clastoptera obtusa (Say).

The Alder Spittle-Insect.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. CERCOPIDÆ.)

Cercopis obtusa SAY: in Jour. Acad. Nat. Sci. Phila., iv, 1825, p. 339; Compl. Writ., Lec. Edit., ii, 1883, p. 256.

Clastoptera obtusa FITCH: in 4th Rept. N. Y. St. Cab. Nat. Hist., 1851, p. 53.—UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 244.—COMSTOCK: Introduc. Entomol., 1888, p. 178.—PROVANCHER: Pet. Faun. Ent. Can.—Hemip., 1889, p. 259.

Its Spittle Observed.

The peculiar frothy masses of the secretion of a spittle-insect were observed on June twenty-seventh, in a large clump of alders, *Alnus serrulata*, at West Albany, N. Y. On every bush of even moderate size hundreds of the masses were clinging. They were believed to be the *Clastoptera obtusa* of Say, which Uhler represents as common on the black alder in July. The larvæ within the secretion may have been at this time half-grown.

Observations on the Insect.

On the seventh of July the locality was revisited for further observation. The perfect insect had made its appearance, and fifteen examples of it were secured. It proved to be, as was expected, *Clastoptera obtusa*. The species had developed unequally, for the spittle masses were still abundant — some containing the larvæ and others the pupæ. Twigs bearing the secretion were collected. When placed in a box for rearing, if possible, the immature insects all left their coverings and traveled over the box within, escaping from beneath a not very close-fitting lid. The larvæ were nearly white. Their legs were long in proportion to the size of the body and were moved rapidly in walking. The pupæ, which had but recently undergone their transformation, show but little coloring, especially on their wing-pads. With increased age they become more deeply colored, and are olive-green on their thorax, wing-cases and legs. The thin, transparent cases from which the larvæ had emerged were adhering to the stems and leaves of the alders.

The Spittle Mass.

C. obtusa belongs to a group of Hemipterous insects, known as "spittle-insects," from the frothy, liquid mass, resembling human spittle, in which the larvæ and the pupæ live concealed. These insects derive their sustenance from the stem or plant or grass upon which they are found, by sucking the juices through the proboscis with which all of the Hemiptera are provided in place of the cutting jaws or mandibles of most of the other orders. The excess of the sap beyond what is needed for their sustenance, is thrown out to form the "spittle" mass, which is often so abundant as to fall to the ground in drops of clear liquid when the imprisoned air has escaped from it.

How the Spittle-mass is Produced.

There seems to be a question as to the manner in which the frothy matter is produced. Mr. Uhler, our authority in the Hemiptera, in Cassino's *Standard Natural History* has stated: "The larvæ live covered by masses of white froth, which the insect produces by expelling from its beak the juices drawn out of the tree." DeGeer, the dis-

tinguished Swedish naturalist, has given an elaborate account of the observations made by him on the method of the spittle production. Wishing to obtain definite knowledge in relation to it, he removed one of the insects from its frothy coverings, wiped it dry with a camel's-hair pencil, and placed it on a freshly cut stalk of honeysuckle in a glass of water. The following is his account of what he saw:

It begins by fixing itself on a certain part of the stalk, in which it inserts the end of its trunk, and remains there for a long time in the same attitude, occupied in sucking and filling itself with the sap. Having then withdrawn its trunk, it remains there, or else places itself on a leaf, where after different reiterated movements of its abdomen, which it raises and lowers and turns on all sides, one may see coming out of the hinder part of its body a little ball of liquid, which it causes to slip along, bending it under its body. Beginning the same movements again, it is not long in producing a second globule of the liquid, filled with air like the first, which it places side by side with, and close to the preceding one, and continues the same operation so long as there is any sap left in its body. It is very soon covered with a number of small globules, which, coming out of its body one after the other, tend toward the front part, aided in this by the movement of its abdomen. It is all these globules collected together which form a white and extremely fine froth, the viscosity of which keeps the air shut up in the globules and prevents its froth from easily evaporating. If the sap which the larva has drawn from the plant is exhausted before it feels itself sufficiently covered with froth, it begins to suck afresh, until it has drawn a new and sufficient quantity of liquid, which it takes care to add to its first stock. (*Memoires pour servir a l'Histoire des Insectes*, Tome 3.)

In another place DeGeer makes this positive statement: "The globules have absolutely no other issue than from the anus."

Purpose of the Secretion.

As to the purpose served by this liquid covering, it has been conjectured that it has the effect of protecting the delicate-skinned insect from the burning heat of the sun, for it can not live long if withdrawn from it, for the insect soon shrinks and speedily dies. It is thought also that the covering protects it from carnivorous insects and other enemies, that but for this concealment would prey upon it. It does not, however, give it entire immunity, for some of the larvæ collected by me at West Albany had been visited with a parasitic attack, and several Chrysopa larvæ were found in such association with the spittle masses that they were undoubtedly preying upon the insects concealed within.

Description of the Insect.

Uhler has briefly characterized it as of a claret-brown color above, marked with two pale bands on the vertex, two on the prothorax, and a wavy, broader band on the wing-covers. The membrane is often

whitish, the waved band is extended exteriorly, and there is a pale v-shaped figure on the end of the scutellum. It is a little larger than *Clastoptera Proteus*, a very common species, living on cranberry and blueberry bushes in swampy places throughout the Eastern United States.

It inhabits Canada, many parts of the eastern side of the United States, and is distributed southwest into Texas, and Tamaulipas, Mexico (Uhler).

Say (*loc. cit.*) has given a more detailed description of the insect, but the above should serve for its identification.

Some of the Spittle Insects.

There are a number of species of the insect which produce and live in this peculiar secretion, constituting the Hemipterous family of *Cercopidæ*, and occurring on various kinds of vegetation, as grasses, several of the weeds, on the grapevine, on willows, pines, etc. One of them, *Ptyelus lineatus* (Linn.), was briefly noticed and illustrated in the *Fourth Report of the Insects of New York*. The species more commonly met with belong to the genera of *Aphrophora* (meaning in the Greek, I bear froth), *Lepyronia*, and *Ptyelus*, meaning saliva. Of the first-named genus, the frothy envelope of the larval *Aphrophora parallela*, is often quite common on the white pine, and I have had drops from it fall upon me with unpleasant frequency when sitting under the branches, while pinning insect collections, in the month of June. *Aphrophora quadrinota* Say, and *A. Signoreti* Fitch, occur on the grapevine, and *A. quadrangularis* Say, on grasses, weeds and blackberry twigs. *Philœnus spumaria* (*Cicada spumaria* of Linnæus), originally described from Northern Europe, also occurs in New York and is quite common in portions of New England.

Popular Names for the Insects.

The more common name for these froth-bearing tree-hoppers in the United States is "spittle-insects." In England the secretion is known as "cuckoo-spittle." The peasants of France know it by the same name, viz., *crachat de coucou*, and also by another, *ecume printaniere*, meaning "spring-froth." Another name that we may sometimes hear applied to it is "frog-spittle," having reference, probably, to its supposed origin. The negroes in Maryland, according to Glover, have a belief that the small forest-flies, so numerous in the woods, are produced from these frothy accumulations. In the final stage of these insects, from their habit of seeking safety in leaping when alarmed rather than in using the wings with which they are provided, they are known in common parlance as "tree-hoppers" and "frog-hoppers."

Their Injuries.

Report has been made in Vermont of one or more of the grass infesting species causing considerable damage to the hay crop. It was estimated that, in consequence of the depredations, the quantity of hay grown on some fields was one-third less than the natural yield, not including the depreciation in the quality of the crop. It is but seldom, however, that these insects increase to such an unusual extent as to become of serious injury, and it is therefore unnecessary to indicate any means for their destruction. A gentleman, who asks for information regarding them, states that, in passing through his mowing fields, in Auburn, Mass., they are so numerous as to wet his shoes. An abundance such as this would, of course, be harmful to the crop, but, fortunately, it is of rare occurrence.

Siphonophora avenæ (Fabr.).

The Grain Aphis.

(Ord. HEMIPTERA : Subord. HOMOPTERA : Fam. APHIDIDÆ.)

Aphis avenæ FABRICIUS : Syst. Ent., 1775, p. 736, No. 13; Sp. Ins., ii, 1781, p. 386, No. 18; Mant. Ins., 11, 1787, p. 316, No. 22 (name only); Ent. Syst., iv, 1794, p. 214, No. 22 (description); Syst. Rhyng., 1803, p. 297, No. 22 (name).

Aphis granaria KIRBY : in Trans. Linn. Soc., iv, 1798, p. 238.

Aphis hordei KYBER : in Germar Mag. Ent., i, 1815, p. 11.

Aphis cerealis KALTENBACH : Mon. Fam. Pflanz., i, 1843, p. 16, No. 6.

Aphis granaria. CURTIS : Farm Ins., 1860, p. 289, f. 39, pl. J. figs. 10, 13.

Aphis avenæ. FITCH : in Count. Gent., xviii, 1861, pp. 96, 114; in Trans. N. Y. St. Agr. Soc. for 1860, xx, 1861, pp. 833–840; in id., xxii, 1863, pp. 32–38; 6th Rept. Ins. N. Y. (6th–9th Repts.), pp. 91–98, pl. 1, figs, 5, 6.— ASHTON : in Proc. Ent. Soc. Ph., i, 1862, p. 141.— WALSH : in id., p. 268.— THOMAS : in Prairie Farmer, Jan. 18, 1862 : 8th Rept. Ins. Ill., 1879, pp. 51–55.—BETHUNE : in Rept. Ent. Soc. Ont. for 1871, p. 57–8, figs. 51–57.— GLOVER : in Rept. Commis. Agricul. for 1876, p. 36, f. 38.— PACKARD : in 9th Rept. Geolog.-Geograph. Surv. Terr., 1877, pp. 710–712.

Siphonophora granaria BUCKTON : Mon. Brit. Aphid., i, 1876, pp. 114–119, pl. 6 (descrip. habits, history, etc).— RILEY-MONELL : in Bull. U. S. Geolog.-Geograph. Surv. Terr., v. 1879, p. 19.

Aphis granaria. ORMEROD : Rept. Inj. Ins. for 1879, p. 22; id. for 1882, p. 14; id. for 1884, p. 25; Manual Inj. Ins. [1881], pp. 63–65.

Siphonophora avenæ LINTNER : in Count. Gent., xlvii, 1882, p. 493; in Rept. Reg. Univ. for 1886, pp. 112–114; in Trans. N. Y. St. Agricul. Soc., xxxiv, 1889, p. 105, f. 3 (as *granaria*).

Siphonophora avenæ. WEBSTER : in Rept. Commiss. Agricul. for 1886, p. 576, (? migration).

Nectarophora granaria OESTLUND : in Bull. No. 4, Geolog.-Nat. Hist. Surv. Minn., 1887, p. 82.

The grain aphis owes its conceded claim to a place among the more injurious insect pests of the agriculturist, in consideration of the vegetation it attacks, its capability for harm, and its wide distribution. It is very generally distributed throughout the grain-producing regions of both continents. It infests all of the more valuable grain crops, as wheat, rye, barley, oats, and many of the other members of the grass family (*Gramineæ*). It is of common occurrence, being found in our fields nearly every year, but, like many other of the more destructive insects, it is only in certain years that, in particular localities, unknown conditions concur in causing its excessive multiplication, when its injuries are very great, even to the almost complete or the entire destruction of the crops attacked. Such an instance occurred in many of the Middle and Eastern States in the year 1861, when, as a new pest of the grain crops, it came under the observation of Dr. Fitch, who gave it careful study and contributed an excellent paper upon it, in his Sixth Report on the Insects of New York, first published in the Transactions of the New York State Agricultural Society for that year. In it are contained its European history, account of its first appearance in this country, description of its three forms, its propagation and habits, its parasitic and other enemies, etc. As this paper is accessible to most who may desire the information that it embodies, only a brief notice will be presented of the insect in this report.

Different forms of the Aphis.

Dr. Fitch observed four different forms of the insect through the season, viz.: 1st, the young louse or larva; 2d, the pupa; 3d, a wingless female; and 4th, the winged female. The last two of these are shown in the accompanying figures.

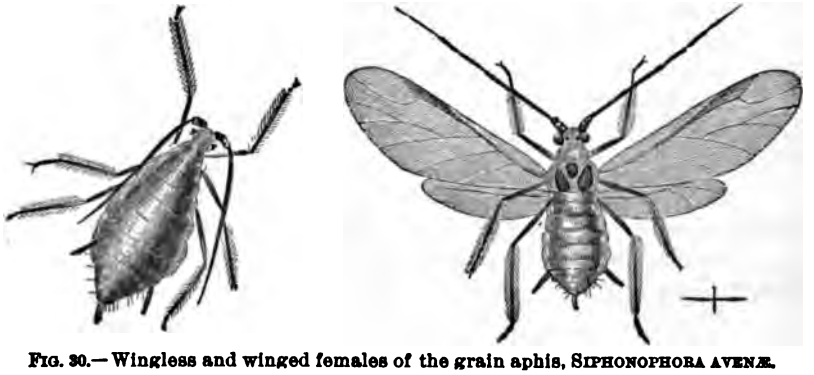

FIG. 30.—Wingless and winged females of the grain aphis, SIPHONOPHORA AVENÆ. (After Fitch.)

The wingless female is described as varying remarkably in color, being either red, green, brown, or yellow. The front is convex in the

middle with a distinct lobe on each side; antennæ black, nearly as long or longer than the body; knees, tarsi (feet), and tips of the tibiæ (shanks), black. The honey-tubes are shining brown, long, and thickened at the base.* The tail large, yellow and recurvel. The winged females, according to Buckton, are generally pale brown or rust-yellow; thorax brown; abdomen ovate, broad and shining green; honey-tubes black; antennæ longer than the body; frontal tubercles not large; legs ochreous, with black knees and feet; tail yellow, ensiform, and hairy.

Dr. Fitch has presented a detailed description of the winged form, which should be consulted. It differs in some particulars from the above, as, for example: The thorax is pale yellow, shining, with a large egg-shaped black or brown spot on each side; abdomen broad oval, grass-green, with a row of three blackish dots on each side; antennæ about equaling the body in length; legs with pale-greenish thighs, becoming yellowish toward their middle, and with dull yellow and black-tipped shanks.

The winged female was observed by Dr. Fitch to be less prolific than the wingless. Inclosed in separate vials, the former uniformly gave birth to two young in a single night, while the latter produced four in the same time. The winged ones were also much slower in coming to maturity.

Method of Attack.

As in other Aphides, its injuries are inflicted by means of its beak or proboscis, which it inserts in the plant for sucking the juices. This beak, which is folded under the breast when not in use, is pale green, black-tipped, and is given out from between the base of the forelegs and reaches half-way to the middle legs. The insect may be first observed early in the season, during the month of May, feeding upon the stalks and leaves, usually on the under side of the blades. As soon as the heads of the grain make their appearance — ordinarily in the latter part of June in New York — deserting every other portion of the plant, all the individuals congregate thereon about the base of the forming kernels, each with its head downward, sometimes crowding together in clusters that nearly cover the head. A remarkable change, according to Dr. Fitch, now takes place in their color; while feeding on the coarser juices of the leaves and stalks they are all of a grass-green hue, but as soon as they change to the more delicate juices of the flowers they begin to assume an orange color. After awhile the orange in most of them inclines either to red or to yellow.

*Mr. Glover records a statement made to him, that although these honey-tubes are well developed, they emit no honey, and in consequence are not visited by ants.

This seasonal change of color, dependent upon the portion and condition of the plant that nourishes them, together with the particular food-plant on which they are observed, will fully explain the discrepancies in the colors assigned to them by different writers.

Abundance in the Year 1861.

Although a few individuals of this aphis had been observed sparsely distributed in grain fields in the State of New York and elsewhere, it had not been regarded as of any economic importance previous to the year 1861. Dr. Fitch knew of no recorded instance in which an aphis, although noted for rapid increase, had become thus suddenly and excessively multiplied over such a wide extent of territory. In the summer of 1861, throughout the greater portion of the New England States, the State of New York, except its western section, the northeastern part of Pennsylvania, and in several localities in Canada, every grain field was invaded by it, and in most of them it abounded in incredible numbers. The yield of wheat was often reduced one-half, while the oat crop suffered still more severely, to the extent of hardly paying for the harvesting.

Not Usually very Injurious.

No demonstration of the insect has since occurred at all comparable with that above recorded. It continues, however, to make its appearance almost annually in considerable or in insignificant numbers. Examples of it are frequently sent to me with inquiries similar to the following, which came from Albemarle county in Virginia:

I send by this mail specimens of flies and aphides with which the wheat-heads all through this section are affected. You will confer a favor upon a large number of farmers in this county by giving the name and nature of these insects, and the information whether they will materially injure the crop.

To the above, after giving the name, habits, etc., of the insect, it was further stated:

"The injuries will be in proportion to their number and of the associated parasites. Heavy and long continued rains would be very serviceable in checking the attack. It is not probable that it will inflict severe injury to the wheat crop now attacked, for the kernels will soon have so far advanced and hardened as no longer to serve for food. Its numbers are, doubtless, being materially lessened by the parasites and other predaceous insects which are preying upon it, judging from the many dead aphids found in the package received. The specimen separately inclosed and marked 'for examination and name,' is the larva of a lady-bug, probably that of *Hippodamia con-*

vergens Guer., which has, doubtless, rendered excellent service in the destruction of the lice. A single one of these larvæ upon a head of wheat should, from its well-known voracity and remarkable appetite, entirely free it in a short time from aphis presence."

Different Names of the Insect.

Several names have been given to this insect, as may be seen in the partial bibliography given of it, since it was first brought to scientific notice, about a hundred years ago. It is the *Aphis avenæ* of Fabricius, Schrank, Walker and others of Europe; of Fitch, Thomas and most of our writers in the United States. Mr. Buckton, in his Monograph of British Aphides, vol. 1, 1876, designates it as *Aphis granaria*, adopting the name given it by Mr. Kirby in 1798, in a paper read before the Linnean Society, on the ground that Fabricius gave no description of his *Aphis avenæ*. In this he seems to have accepted without examination, the statement made by Curtis in his *Farm Insects*, viz., "as Fabricius has given no description of his *Aphis avenæ*, which is possibly the same species [with Kirby's], Mr. Kirby was constrained in describing it, to designate it by a new name." Both these gentlemen have very strangely, as was some time ago pointed out by Dr. Fitch, overlooked the description of Fabricius. In the earlier Fabrician writings — *Systema Entomologiæ* in 1775, *Species Insectorum* in 1781, and in *Mantissa Insectorum* in 1787, the species appears only by name, but in the *Entomologia Systematica* in 1794, it was sufficiently described to indicate beyond doubt the insect named; and that there need be no excuse for longer continuing the name of *granaria*, the description contained therein is herewith given :

Avenae. 22, A. Avenae sativae.
Habitat in Avena sativa.
Caput obscure testaceum antennis nigris. Thorax testaceus, antice viridis. Abdomen viride lituris marginalibus, nigris. Corniculi cylindrici, nigri. Anus terminatur stylo parvo, albo. Pedes nigri femoribus basi albis.

That Kirby's name, published four years later, may be seen to have no claim to priority or adoption for any reason whatever, we quote from the Transactions of the Linnean Society, for 1798:

A. granaria, viridis, cauda biseta, setis geniculisque pedum nigris.

Aphis avenæ. Fab. Sp. Ins., ii, p. 386, N. 17.
Gmel., i, pt. iv, p. 2206.
Caput flavidum uti antennarum articulus primus. *Oculi* nigri. *Abdomen* obovatum cauda aculeata. *Pedes* livida, tarsis geniculisque nigris.

As may be seen from the synonymy presented, Kyber, a distinguished anatomist and microscopist, who early in the present century, made valuable researches and discoveries in the Aphides, gave the name of *Aphis hordei* to the insect, from the barley on which he found it feeding. Later, Kaltenbach, another German naturalist named it *Aphis cerealis*. More recently, it has been transferred to the genus *Siphonophora*, in the division that seemed demanded of the *Aphidinæ* into separate tribes. Still later, another writer, Mr. Oestlund, in his *Synopsis of the Aphididæ of Minnesota*, has transferred all of the Siphonophoras to the genus *Nectarophora*, assigning as a reason for proposing to replace the familiar name of *Siphonophora*, that "as a generic term it was already appropriated for the Myriopoda before Koch made use of it in the *Aphididæ;* and it is also used to denote an order of the Oceanic Hydrozoa, and should, therefore, according to practice, be replaced by one not already occupied." This proposed change will not, we think, be accepted, until demanded by a code of laws regulating nomenclature that shall rule authoritatively.

Its Incomplete Life-history.

The life-history of the grain aphis is incomplete; the male sex, although a form was described by Curtis as such, is still unknown. The summer form is believed to have an autumnal migration to some other food-plant, as have many of the Aphides, yet it has never been observed. Mr. Walker has affirmed that this species migrates in autumn from the wheat to several kinds of grass.

Professor Webster has made some experiments toward ascertaining where the species passes the summer, or until the young wheat appears in the autumn. It was infesting the heads of barley in considerable numbers, and when the grain was fully ripe and the winged adults ready to forsake the barley heads, he transferred some of them to cages, in which growing timothy, blue grass, and red top had been transplanted. The grasses were kept alive, but the insects died, and no trace of a following generation was observed. (*Loc. cit.*)

Buckton had searched the roots of grain in September for its supposed underground habitat at that time, but fruitlessly; nor did he know what became of it during the winter. Since then, Dr. Thomas has been able to add somewhat to our previous sparse knowledge of its life. He found on wheat, in the winter of 1875, an aphis, which, although differing from the descriptions of Fitch and Curtis, he had no doubt was the same species, and he has written of it as follows:

"When the winter wheat appears above the ground in the fall, it passes from its hiding-place at this time, wherever that may be,

probably in the same way that it does from the winter wheat to the spring wheat and oats in the spring, that is, by the winged individuals. Here they work upon the leaves and stalks singly while the weather is not too cold, but when winter appears they move downward toward the ground, some of them, at least, entering the soil and feeding on the sap of the roots. At any rate, I find the apterous ones at this time working upon the roots, but at the same time I find a winged individual above ground.* I have observed them heretofore at the root of the wheat late in the winter, while snow was on the ground, and, what somewhat surprised me, I found them busy at work under the snow, and the apterous females bearing well-formed larvæ. I am, therefore, led to believe that in this latitude the species passes the winter in other than the egg state. This will probably be found true wherever winter wheat is grown."

The above will serve to show how much yet remains to be learned of the life-history of this species. A male unknown and no knowledge of an egg-laying female, should be a sufficient stimulus for its further study. Dr. Fitch has written of it: "I have watched the grain aphis this year [1862] round so closely that I am perfectly assured that no eggs were laid and no males were produced. When and under what circumstances males occur, if they ever do occur, is yet remaining to be discovered. At present it seems as if these insects might go on forever producing young without any intercourse of the sexes."

Is it possible that this species will be found to confirm a statement made by Kyber, a careful and skillful student of the *Aphididæ*, that certain species that feed on herbaceous plants which fruit early in the year and then wither, produce males and apterous oviparous females *in the middle of the summer?*

Its Food-plants.

The grain aphis is by no means confined to wheat, barley, and oats. Kaltenbach has enumerated as its food-plants *Secale cereale* (rye), *Triticum sativum*, *Avena fatua*, *Hordeum murinum*, *Bromus mollis* (soft chess), *Dactylis glomerata* (orchard-grass), *Holcus* and *Poa*. Walker has added *Glyceria fluitans* and *Polygonum persicaria*. Passerini records it on various species of sorghum in Europe, including *Sorghum saccharinum*. Mr. Oestlund has found it in Minnesota, on *Phalaris canariensis* (canary-grass) and on *Poa annua*.

*See, in this connection, a statement made to Mr. Glover, which would seem to indicate an unusual degree of endurance of cold (although doubtless not to the extent reported), viz., that "they freeze on the stalks in winter and revive in the spring."

Remedies and Parasites.

The use of salt, of soot, of gas-lime and of several other substances has been proposed as remedies for this insect, but we are compelled to admit that no method has been discovered by which its formidable attack upon a grain crop can be arrested. Fortunately, in nearly every instance when it has abounded, it has been promptly met by hosts of parasites which have done their work so effectually* that if the attack was not at once checked, it was not repeated the second year, or if continued, then ceasing to be serious and soon brought to a close. It is the particular province of a group of ichneumon flies to feed internally on plant-lice and restrain materially their rapid and prodigious increase. They belong to the family of *Braconidæ* and to the subfamily of *Aphidiinæ* — its name indicating the close relationship to the Aphides that it bears. About fifty species of these have been described from the United States and Canada by the three authors who have given them particular study — Mr. Ashmead, Dr. Fitch, and l'Abbé Provancher. The two species that were bred by Dr. Fitch from the grain aphis were named by him *Praon avenaphis* and *Toxares triticaphis* — their hosts having occurred on oats and wheat. Curtis, in his *Farm Insects*, has described *Aphidius avenæ* and *Ephedrus plagiator* which he obtained from the grain aphis in England.† A single one of these parasites entirely fills the body of the aphis, causing it to swell into a globular form. The infested aphis, fastened to the plant, is indicated by this distended form, its sienna-brown color usually, and later by the round opening on the back through which the parasite has emerged.

Myzus cerasi (Fabr.).

The Cherry Aphis.

Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. APHIDIDÆ.

FABRICIUS: Syst. Ent., 1775, p. 734.4; Spec. Ins., 1781, ii, p. 384.4; Mant. Ins., 1787, ii, p. 315, No. 6; Ent. Syst., iv, 1794, p. 211, No. 6 (*Aphis*).

FITCH: in Trans. N. Y. St. Agricul. Soc. for 1854, xiv, 1885, pp. 829–833, 836, 837; 1st Rept, Ins. N. Y., 1856, pp. 125–128, 132, 133 (*Aphis*).

BUCKTON: Mon. Brit. Aphides, i, 1876, p. 174, pl. 33, figs. 1–5 (*Myzus*).

THOMAS: 8th Rept. Ins. Ill., 1879, p. 75-6 (*Myzus*).

SAUNDERS: Ins. Inj. Fruits, 1883, p. 216–7.

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*Mr. Curtis has written: On some wheat which we examined not a single aphis had escaped the searching vigilance of its enemies, and the husks were spotted with innumerable black globules [the bodies of Aphids which had been parasitized by *Ephedrus*]. *Farm Insects*, 1860, p. 291.

†For notices of other species of *Aphidiinæ*, their oviposition, etc., see 1st *Report of Dr. Fitch on the Insects of New York*, 1856, pp. 134-138, and Buckton's *Monograph of British Aphides*, 1879, ii, pp. 151-153 (Aphidivorous Ichneumonidæ). For recent descriptions of many new species, see Ashmead, in *Proceed. U. S. Nat. Mus.*, 1888, pp. 656-671.

Although with no new observations to present upon this insect, the inquiries recently made from some of the eastern fruit districts in the State of New York, of means for preventing its injuries, call for information in regard to it, and the following is, therefore, accordingly presented, compiled from the writings of Dr. Fitch and other careful observers:

Myzus cerasi, the *Aphis cerasi* of Fabricius, is the common black aphis of the garden cherry, *Cerasus vulgaris* — long known as quite destructive to cherry trees in Europe, whence it has doubtless been introduced in this country. It is rare to find a tree that is wholly exempt from it, and it often occurs in such incredible numbers upon the underside of the leaves, that, completely covering them, it overflows upon the leaf-stalks, the ends of the tender twigs, and even upon the young fruit. The larger infested leaves do not curl but turn backward or roll slightly. The more tender leaves upon the delicate twigs being drained of their juices, shrivel and dry and die, as do also the tips of the twigs. To such prodigious extent does this species sometimes multiply, that a single young tree that had attained a height of ten feet, harbored, according to a calculation made by Dr. Fitch — by taking the average number on a single leaf, counting the leaves on a branch, and the branches on a tree — at least 12,000,000 of individuals.

Life-history.

Its life-history, according to Dr. Fitch, who had not observed its underground operations, is the following: It makes its appearance as soon as the leaves put forth in the spring, hatching from eggs deposited the preceding autumn. During the spring and summer, winged and wingless forms are found; nearly all are without wings, and all are females. They continue to produce living young throughout the summer, which, when hatched, are smaller and of a brighter color than when mature. They multiply with exceeding rapidity, so that by the middle of June, in New York, the trees are literally overrun with them. Toward the latter part of the month, they are often attacked so vigorously by the larvæ of Syrphus flies and the lady-bugs (*Coccinellidæ*) that their ravages are temporarily checked and their numbers greatly diminished. If apparently exterminated, new broods shortly appear and resume their work, but they are incapable of inflicting as serious harm upon the now mature foliage, as at their first advent. On the approach of cold weather, male aphides make their appearance, and eggs are deposited at the base of the buds and in the crevices of the bark for the continuation of the species another year.

Mr. Buckton has given but few items relating to the life-history of this species. He states that two swarms occur in the year with a certain interval, one in June and the other in October. During the latter period the male makes its appearance, which he had taken under the leaves of the garden cherry in company with oviparous females. Mr. Walker had taken the latter on October thirty-first.

Description.

The careful description given of the insect in its several stages, leaves but little to desire. For those who have not convenient access to the first report of Dr. Fitch, we condense from it, as follows:

The LARVÆ when newly born are about 0.03 long, of a dull white or pale yellow color, with transparent and colorless legs and antennæ. They are oblong-oval in form, with the opposite sides of their bodies parallel, and their transparent or slighly dusky nectaries not reaching to the tip. Later, they become broader across the abdomen and deeper yellow, with the tips of the antennæ and the feet dusky and the nectaries black. After molting they change to dull reddish-brown or chestnut colored, with black heads. The legs, antennæ, and nectaries are whitish transparent.

The WINGLESS FEMALES are 0.05 long, broadly egg-shaped, black and shining, with a tail slightly projecting, nectaries black and reaching to or beyond the tip; the antennæ are shorter than the body and whitish, their two short basal joints and the apical half, black; the beak whitish, black-tipped; the legs white, with the feet, tips of the shanks, and commonly the thighs, at least of the hind legs, except at their base, black. [Cauda long and black — Buckton.]

The PUPÆ are 0.06 in length, resembling the wingless females in color and the larvæ in form, but may be known by the rudiments of wings like vesicular scales of a white or pale green color; the nectaries equal the tip which has no tail-like appendage.

The WINGED FEMALES are 0.05 long, and 0.20 across the wings; of a deep black and shining color; abdomen nearly twice as broad as the thorax, egg-shaped, with an acute apex having a short conical tail-like appendage, the nectaries reaching to its base; antennæ black, and about three-fourths the length of the body; beak black or dusty with a black tip; the legs black with the shanks, except at their tips and the basal half of the thighs, white. The wings are transparent, their bases, outer margins and rib-vein, white, the remaining veins blackish with their bases pale; the stigma opaque, dull white with black margins.

Food-plants.

Dr. Fitch was of the opinion that the cherry aphis lived only upon the garden cherry — not on any of our native or wild cherry trees, or upon any other tree. This opinion has not been sustained by our further acquaintance with the insect. Thus, in the year 1878, Dr. Thomas found it in Illinois, covering the twigs and axils of the small limbs of plum trees as well as the cherry, in confirmation of the statement of its occurrence on the plum that had been previously made by Mr. Walsh.

Mr. Buckton has observed viviparous specimens of it in limited number, on the black currant, showing the slight colorational difference of a duller body and paler cornicles.

It is possible that this species also extends its ravages to the peach tree, appearing there as a root-form infesting the roots. For many years past, the roots of peach trees along the Atlantic seaboard have been seriously infested with an aphis, to the extent of causing a great mortality, particularly in seedling trees. The attack was naturally referred to *Myzus persicæ*, but by some has been regarded as a distinct species. Examples of it sent to the Department of Agriculture at Washington, were pronounced by Professor Riley to be the *Myzus cerasi* of Fabricius, but in correspondence with him, the opinion is expressed that before its identity with that species can be positively asserted, additional study is necessary. For a notice of *M. ?cerasi*, on the roots of peach trees, the *Second Report on the Insects of New York*, pp. 19–22, may be referred to.

Remedies.

A kerosene and soap emulsion sprayed upon the insects would effectually kill all with which it came in contact. Clustered as they are on the under sides of the leaves, it would be necessary to apply the liquid from beneath the tree, changing position as might be necessary in order to reach every portion of the infested foliage. The statement of Dr. Fitch, that "these are creatures that *sprinkling* will not cleanse from the tree — *immersion* must be resorted to," may have been warranted by the sprinklers then in use, but is not sustained by the progress subsequently made in the discovery of insecticides and improved instruments for their application.

Strong soap-suds alone, although not entirely effectual, will materially reduce the aphids upon a tree — only the more hardy ones surviving its use.

Tobacco water, if made of sufficient strength, is claimed to be an effectual remedy for the insect. It has been used with unfailing suc-

cess when prepared "by boiling four or five pounds of tobacco in water sufficient to nearly fill a tin pan"— an indefinite measure, but a pan such as used upon a farm for milk may be presumed.

Dr. Fitch, at the time of his writing, regarded, as the very best measure for subduing these pests, that of using their natural enemies for the work. This was to be done by collecting from the hedges and borders of the forest in the neighborhood, by the aid of a beating-net, such as is sometimes used by entomologists for gathering insects, or an open inverted umbrella, or some other convenient implement, a few scores of their natural enemies (lady-bugs and their larvæ) and, conveying them alive in small boxes and vials, to set them free upon the infested tree. Their increase would be so wonderfully rapid that but a short time would be required to put an end to the aphis attack.

The convergent lady-bird, *Hippodamia convergens* Guer. [its orange-red wing-covers dotted with black spots and its black thorax marked with two converging pale lines, as shown in the slightly enlarged Fig. 31 at *c*, and in Fig. 32 more enlarged] could be conveniently used for this purpose early in the season, as it may be gathered by thousands during the month of May on the common Mayweed (*Maruta cotula*), and no better investment could be made by those who wish to destroy plant-lice than in the employment of boys to collect these lady-birds, four or five of which will clear a two-year-old peach tree in as many days (Riley, in *New York Tribune* for June 17, 1874).

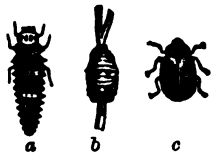

FIG. 31. — The convergent lady-bug, HIPPODAMIA CONVERGENS; *a*, the larva; *b*, pupa; *c*, the imago or beetle.

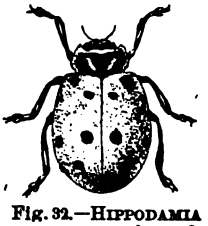

FIG. 32.—HIPPODAMIA CONVERGENS, enlarged.

INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS.

A number of the following notices were contained in the Report of the State Entomologist to the Regents of the University, S. N. Y., for the year 1885, as published in the *Thirty-ninth Annual Report of the New York State Museum of Natural History*. No separates of the Entomologist's Report having been printed for general distribution, and the edition of the State Museum Report being quite small, portions of the former are herewith republished, that they may reach the agriculturists for whose benefit they were primarily prepared.

The Canker-worm.

Anisopteryx vernata (Peck).

It really seems that the canker-worm is becoming an annual pest of the orchards of the State of New York. While the New England orchards have been for many years ravaged by it, and the noble elms, so long the boast of eastern villages, destroyed, and it has also been

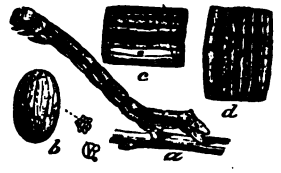

FIG. 33.—Larva and eggs of the spring canker-worm—ANISOPTERYX VERNATA. (After Riley.)

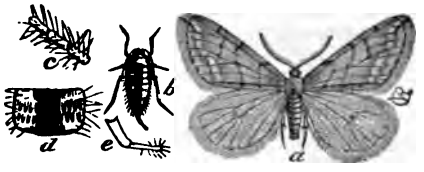

FIG. 34.—*a*, *b*, male and female moths of A VERNATA; *c*, enlarged joints of female antenna; *d*, joint of female abdomen; *e*, ovipositor.

very destructive in several of the Western States, our own State, for some reason, has been almost exempt from its depredations. Within the last few years, occasional instances of its occurrence have been reported. Last year [1884] they were received from Poundridge and Pleasantville, in Westchester county, where they inflicted damage to the apple crop to the amount of thousands of dollars (*Country Gentleman* of July 10, 1884, p. 577). The present year, report is received of serious injuries from them in Wayne county. A gentleman writes:

"The orchards are all being destroyed in this part of the State by the canker-worm. Thrifty orchards were cut down last winter, and there will be many more sacrificed if there can not be found some way to stop the havoc."

Early in June their presence in the vicinity of Albany was reported, where I had not previously heard of their occurrence. Examples of the caterpillar were brought to me by Mr. David M. Knickerbocker, of Albany, that I might see if they were, as he believed, the veritable canker-worm. They were found upon his apple trees at Loudonville, in "millions," and were rapidly consuming the foliage. He had also heard of their presence in other orchards in his neighborhood. The examples of the larvæ brought were nearly full-grown (on June ninth), having almost attained their maximum length of one inch. As usual, they differed greatly in their markings and colors, some being almost without stripes and of a uniform black.

The folly and the criminality of permitting this destructive pest to obtain a permanent footing within our State can not be too strongly censured. It is an extremely local pest and, at the outset, can be easily controlled. Often one tree only in an orchard is infested, or a portion of an orchard, or a single orchard in a township, while others are wholly free from it. The female moth has no wings with which to distribute herself, and can only, upon coming out from her pupation in the ground underneath the tree in the early spring, climb up the trunk, meet her winged mate, and deposit her eggs upon the branches.

Preventives and Remedies.

The preventives and remedies that should be used against this insect are simple. First, the females should be prevented from ascending the tree, by cloth bands, coated with tar or printer's ink, around the trunk, or by some of the mechanical appliances which have been so frequently described in our agricultural journals and entomological reports. Second, when the larvæ are upon the tree and rapidly consuming the young leaves, they should be killed by spraying the tree with Paris green water, as in directions so often published. Third, if the caterpillars have been permitted to feed to maturity upon the trees, and thereafter to enter the ground immediately beneath for their transformation, the soil under the trees to the depth of from four to six inches should be thoroughly worked so as to crush the tender pupæ.

Either one of the above measures, if properly used, will be effectual in arresting the attack. If all are employed, immediate success would be insured.

Abundance of Geometrid Larvæ.

Mr. Verplanck Colvin, Superintendent of the New York State Land Survey, writes from his camp, on Salmon lake, head-waters of Beaver

river, under date of August 5, 1888, as follows, of some insects that came under his observation:

I believe you would be interested were you with us, for we are constantly meeting what are, to us, such novel forms of insect life that I feel confident you would find some undescribed species. What seems to me most novel, from an entomological standpoint, is the abundance of larvæ of the kind known as "measuring-worms." I never saw so many of these insects in the woods. They attack the witch-hobble [*Viburnum lantanoides*], which is usually quite free from insect injury, and reduce the leaves to skeletons. But they do not, by any means, confine their attack to deciduous vegetation, but are also found on evergreens—on balsam and spruce—and their number is infinite. The common form is a bright green worm of about one inch in length: another is a dark gray or brown. Both of these attack the human being with a sharp and painful bite — a surprising thing, as I have never known such larvæ to attack animals before. They are certainly worthy of your observation and study.

THE APPLE-LEAF BUCCULATRIX.

Through Dr. Sturtevant, of the New York Agricultural Experiment Station, a communication was received from Mr. Malcolm Little, of Malcolm, Seneca county, N. Y., stating that the apple orchards in that vicinity were infested upon the branches and the fruit with objects such as sent upon some twigs. They had not been seen before, and it was asked what they were, and if they would probably prove injurious. Answer to the following effect was returned:

The twigs received were thickly covered on one side with the cocoons of the apple-leaf Bucculatrix — *Bucculatrix pomifoliella* Clemens. A piece of twig an inch and a quarter in length, and one-eighth of an inch in diameter, had upon it thirty-three of these cocoons. From the small size and the general appearance of the cocoons they are often mistaken for insect eggs. They are white, about one-fourth of an inch long, as thick as an ordinary pin, and show upon their exposed surface five or six prominent longitudinal ribs as represented at *a* in Fig. 35, and at *b* in enlargement.

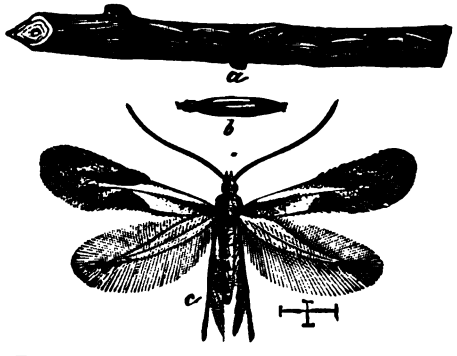

FIG. 35.— Apple-leaf Bucculatrix. BUCCULATRIX POMIFOLIELLA: *a*, piece of twig covered with cocoons; *b*, cocoon enlarged; *c*, the moth, enlarged.

The insect is an injurious one. Where it abounds, the caterpillars consume such an amount of the foliage as seriously to interfere with the production of the fruit. It displays a remarkable facility for

increase, and every proper means should, therefore, immediately upon its discovery, be resorted to, that its spread may be arrested.

The parent is a small moth (shown at *c*, much enlarged) belonging to the *Tineidæ* — that division of the Lepidoptera that embraces the smallest species of the order. There are two annual broods of the insect. The cocoons sent to me are of each brood. Some of them were spun in July, and have given out the insect, leaving only the empty pupa-case within the cocoon. The moths that emerged from them laid eggs from which the caterpillars were hatched, which might have been observed feeding upon the leaves in September, if attention had been given at the time to the eaten foliage. The caterpillars make their cocoons during October, and upon opening those that are the freshest-looking and unbroken, the pupæ may be found which are destined, if not meanwhile destroyed through parasitic or atmospheric agency, to remain in that state throughout the winter, and to give out the moth in the month of May next.

A notice of this insect, containing further information upon it, may be found in my "First Annual Report on the Insects of New York, 1882, pages 157–162."

Distribution.

In the above publication, the presence of this insect had only been reported within the State of New York, in Monroe and Chemung counties. As would naturally be expected, it seems to be extending its range. It has since been received by me, from an orchard of Mr. J. S. Roy, Lyons, Wayne county. A piece of twig only two and one-half inches long contained twenty-two of the cocoons. It has also been sent to me by Mr. J. C. Wolf, of Waterloo, Seneca county. It is reported as present, in small numbers as yet, in Lagrange, Wyoming county. It also occurs in South Byron, Genesee county.

I had previously written of this insect, that as yet in its New York distribution, it was apparently confined to the western portion of the State, but the present year it has been brought to me from an orchard at Bethlehem Centre, five miles south of Albany, on the Hudson river. Mr. Isaac Bussing, with whom it occurred, reports that he has observed it upon his trees for the past few years, in limited numbers, but does not think that it inflicted serious harm.

In the *Second Report of the Department of Entomology of the Cornell University Experiment Station*, 1883, Mr. A. E. Brunn has published his studies upon the life-history of this insect (with illustrations of some of its stages) which adds materially to our previous knowledge of it (*l. c.*, pp. 157–161, pl. 6, figs. 2–2*e*). An abstract of the above observa-

tions has been given by Professor J. H. Comstock, in the *Proceedings of the Western New York Horticultural Society*, at its twenty-eighth annual meeting in January, 1883 (pp. 20–23).

Remedies.

This injurious pest is the most vulnerable in either its caterpillar stage or after the cocoons have been made. In large orchards the cocoons may be best attacked by means of a mixture of kerosene and soap sprayed upon them with a force-pump. This emulsion which is quite as effectual as, and easier to make than, the milk emulsion formerly recommended, may be made by dissolving two pounds of common bar soap in a gallon of water, with heat, and then mixing in a gallon of kerosene with the aid of a force-pump until emulsified. This, upon cooling, will form a thick, gelatinous mass, containing fifty per cent of kerosene, which will have to be reduced by the addition of water before it can be applied with a force-pump. If diluted with nine gallons of water, giving a mixture of about ten per cent of kerosene, it should give a strength sufficient to destroy the pupæ within the cocoons, but the proper strength had better be first ascertained by experiment upon a few of the cocoons.

If the infested trees are not very numerous the emulsion might be applied to the branches by means of a stiff bristle-brush, which would remove the cocoons, and serve to show thereafter if there is a continance of the attack in the deposit of fresh cocoons.

When the caterpillars are found in abundance feeding on the trees in July or September, by suddenly jarring the branches, numbers will drop and hang suspended by their threads, when they may be swept down by brooms or branches and destroyed. Showering the trees with Paris green and water would kill all the larvæ eating the poisoned foliage.

THE CLOVER-SEED MIDGE.

Cecidomyia leguminicola Lintn.

A package of the larvæ of the clover-seed midge was received October twelfth, through Dr. E. L. Sturtevant, from Mr. D. M. Linsley, of Orleans county, N. Y., with the statement that they were from a second crop of clover, that had been cut for hay, and placed on a scaffolding above the barn floor. Four or five days thereafter the larvæ were observed in large numbers upon the floor beneath the clover. Mr. Linsley was desirous of knowing if they would attack any other grain or plants. Answer was made that the attack of the clover-seed midge, so far as known, was confined to clover seed. From the abundance of the larvæ reported by him, it was quite important, as a

means towards diminishing the attack of the coming year, that the larvæ falling upon the floor should be frequently swept up (if the floor was a tight one) and burned. If in the sweeping the larvæ were liable to fall through the floor-joinings, it would be advisable to kill them before attempting their removal by sprinkling them from time to time with kerosene.

The following extracts are from a letter received later from Mr. Linsley in reply to the request made for additional information of the occurrence of the larvæ:

They came wholly from the second cutting of the clover, cut about the twentieth of September. They began to make their appearance about four days after it was drawn into the barn. They came out in such numbers that they looked like red sand upon the floor. This continued for about two weeks, since which time I have not noticed any of them. I destroyed what I could collect from the floor, but the greater part of the hay being put into a mow, they were, of course, out of reach for the most part. * * * * *

It is said that these weevils do not work in the Alsike, or large pea-vine clover. This may be due to the fact that in these varieties the first growth of cutting is used for seed, so that the seed matures too early for the insect. But these varieties are far inferior to the Medium clover and can not well supply the place of it. The destruction of the crop of Medium clover seed is a very serious loss to the agricultural interest in this portion of the State, amounting to from twenty to forty dollars per year on every farm of 100 acres, according to the market price of the seed.

The Hessian-fly.

Cecidomyia destructor Say.

Wheat infested between the first and second joints with the Hessian-fly, was sent for examination, June twelfth, by Mr. A. F. Dowd, of North Huron, Wayne county, N. Y. On stripping the sheaths from the stalks, four or five of the puparia, or "flaxseeds" as they are popularly called, would be found in company, showing the attack to be a severe one. [See figure 45 on page 286.]

The perfect insects failed to develop. Under natural and favorable conditions they would probably have emerged in the month of July.

The fly had been more injurious in western New York the preceding year (1884) than usual. The following statement in relation to its operations, and containing some good suggestions for controlling the insect, is from a gentleman in Monroe county, which joins Wayne county on the west:

A considerable part of the wheat of 1884 was injured by the Hessian-fly, which crinkled the straw so that the heads of wheat were cut off too short to be gathered in harvest. On some fields this scatter-

ing wheat would make, if evenly distributed, a sufficient seeding. I am afraid this self-sown wheat will prove a detriment to the crop, as the Hessian-fly will lay her eggs on these early plants.

The fly works until frosts check it. Rolling the ground or dragging with the smoothing harrow, and then rolling, is probably as good a preventive of injury from the Hessian-fly as can now [late in September] be applied. These operations both cause the wheat to stack more, making a mass of small leaves rather than one or two tall ones from each plant. As the fly lays her eggs in the fold of the leaf [at the crown of the root], she finds less place than where the leaves are unchecked in growth. Besides, many of the eggs and newly-hatched worms are destroyed by crushing and contact with soil brushed against them.—W. J. F., Monroe county, N. Y. (*Country Gentleman* for October 9, 1884.)

Some plants of winter wheat in ground, containing the flaxseeds of the Hessian fly, were received from Prof. F. M. Webster, of La Fayette, Ind., on April fourteenth. On April nineteenth six of the flies emerged, males, and additional ones as follows: On the twentieth, four ♂; on twenty-first, seven ♂ and fourteen ♀; twenty-second, not observed; on twenty-third, about sixty ♂ and ♀ were taken from the box, some of which were dead.

SCIARA SP. ? OCCURRING ON WHEAT.

Examples of a small fly were received October second, from Dr. E. L. Sturtevant, which "had appeared upon wheat" at the Experiment Station.

In our present limited knowledge of the species of this genus, a generic determination only could be made of it.

From what is known of the larval habits of the few *Sciara* that have been studied, and of their associated *Mycetophilidæ*, it is not probable that the species sent was injurious to wheat. The larvæ, as a class, are not regarded as injurious, as many of them are known to occur beneath the bark of felled trees, in decayed wood and vegetables, in vegetable mold, in fungi, etc.

From their frequent occurrence in boleti and fungi, Latreille had arranged the *Mycetophilidæ* in his group of *Fungivores* — one of the five into which he divided the *Tipulidæ*. A noted fungivorous species is the *Sciara Thomæ* Linn., of Europe, known as the "army-worm" (Hierwurm) in Germany. The larvæ are remarkable for assembling in immense numbers and hanging together by means of a viscid moisture in a long mass resembling a snake or rope, sometimes several feet in length, two or three inches in breadth, and perhaps a half inch in thickness. Larger processions of these larvæ have been observed,

massed in a breadth of three inches and one or two inches in thickness, and extending thirty yards in length. Individually, they are but about five lines long and a third of a line in diameter. M. Guérin-Méneville has given interesting details of some of these assemblies observed by him, some of which have been quoted in *Figuier's Insect World*, pp. 46, 47.

That some of the species of the genus may possess injurious habits appears from the mention by Prof. Westwood, that Olivier had reared three species of *Sciara* from wheat, of which account is given in *Prem. Mém. sur quelques Insectes qui attaquent les Céréales*, Paris, 1813.

Sciara pyri, of Europe, is said to injure the blossoms and fruit of the pear, causing them to fall; while of other European species, *S. fucata* lives in decaying potatoes, turnips and other vegetables; *S. quinquelineata* breeds in diseased potatoes and is supposed, by some, to cause the "scab;" *S. pulicaria*, *S. vittata*, *S. longipes*, and *S. hyalipennis*, have also been bred from decaying potatoes; *S. tilicola* produces a gall on the leaves of young linden trees; and *S. Giraudii* has been bred from stems of *Malva* and *Althæa*.

One of our American species, at least, is known to be injurious, viz., *Sciari mali* (Fitch), the larvæ of which destroy the interior of apples by burrowing through them, while the fair exterior shows no indication of the concealed attack. A species of *Sciara*, apparently near to *S. nervosa*, of Europe, has recently been brought to me (1889), as infesting mushroom beds in Albany, where it has been regarded as injurious to mushroom culture. Mr. Wm. Falconer has also sent me the same species from mushroom cellars in Glen Cove, Long Island, but does not consider it harmful. It will be given study, and reported upon hereafter.

The Osten Sacken catalogue of N. A. Diptera contains twenty-three species of *Sciara* described by Say, Walker, and others, but of these very few have been identified in present collections. For notice of the habits of some of the *Sciara*, see Osten Sacken, in *Proc. Ent. Soc. Phil.*, i, 1862, pp. 163–165; and for references to writings upon them, pp. 169–171.

THE CABBAGE-FLY.

Anthomyia brassicæ Bouché.

A severe attack of this insect upon young cauliflower plants was reported by Mr. D. W. Seeley, of Albany, and examples of the plants badly eaten and having the larvæ within and upon their roots, were brought to me on June eighth. Mr. Seeley had made several appli-

cations of popular remedies for the arrest of the attack, without avail, and had nearly determined upon taking up the entire crop and destroying it, although it would be at a loss of about a thousand dollars — the estimated value of the matured crop. The application of bisulphide of carbon was recommended to him before an abandonment of the crop; the result of the application, if made, was not learned.

Some of the above larvæ, apparently full-grown, were placed in a box with ground when received. Sixteen days thereafter, June twenty-fourth, they gave forth the perfect fly.

A LADY-BUG ATTACK ON SCALE-INSECTS.

A number of Austrian pines, *Pinus Austriaca*, in Washington park, Albany, were observed, on October ninth, as having been very nearly killed by an attack of the pine-leaf scale-insect, *Chionaspis pinifolii*

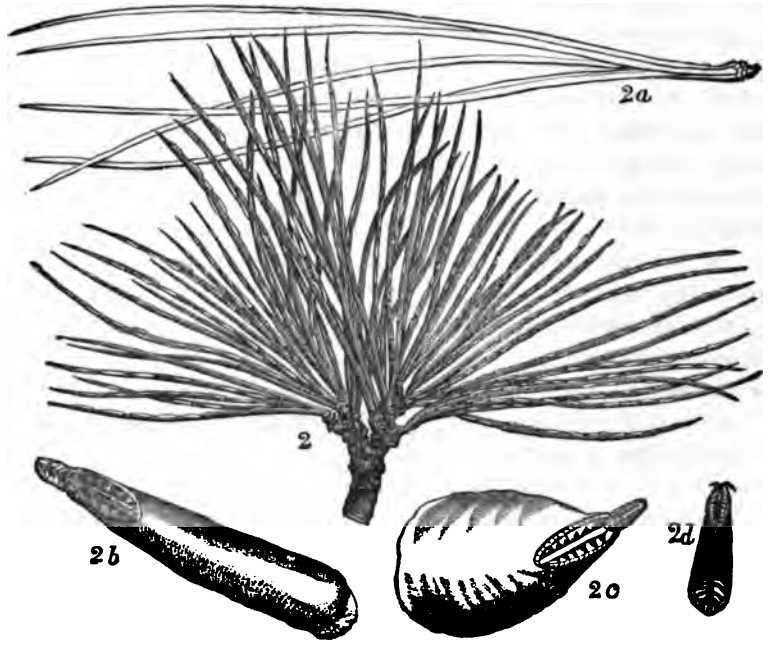

FIG. 36.— The pine-leaf scale-insect, CHIONASPIS PINIFOLII.

(Fitch). Millions of the peculiar white scales of this destructive species had attached themselves to the leaves almost as thickly as they could find place, to the extent of whitening the tree, and nearly hiding its

natural green. Hundreds of scales could be counted upon a single one of its slender leaves. The scales are represented in Fig. 36 in their natural size on the leaves of *Pinus strobus*, at 2. At 2*a*, are leaves of the same not stunted by the presence of the scales; 2*b*, a scale of female, of usual form, enlarged; 2*c*, wide form of the same, enlarged; 2*d*, a male scale enlarged. The figure is from Prof. J. H. Comstock's *Report to the U. S. Department of Agriculture* for the year 1880, while Entomologist of the Department.

The species of lady-bug, *Chilocorus bivulnerus* Muls., which seems to be specially commissioned to feed upon the eggs of this and other scale-insects, was present upon the trees in great abundance. Its larval stage had already passed, and it was now occurring in its pupal and perfect stages. The larval cases, split longitudinally upon their back, and disclosing the pupal case within, were quite numerous; as many as ten of these could be seen upon a single leaf. The larger number of pupæ had given out the pretty beetle, with its shining black wing-covers, bearing centrally upon each a blood-red spot — the two spots suggesting the common name that it bears of "the twice-stabbed lady-bird." A few of the beetles were still emerging, with pale ochraceous-colored elytra, and without the least indication of the two red spots which are gradually developed later with the darkening of the wing-covers. In a few minutes time, about one hundred and fifty of the beetles were collected from the leaves and branches of a pine — most of them from the branches, on which they were found quietly resting.

Fig. 37.— The Twice-stabbed lady bird, Chilocorus bivulnerus: The larva and imago.

An examination of the scales upon the more badly infested trees showed that most of them had been eaten into and their contents destroyed.

From pupæ collected and taken to my office, the beetles continued to emerge for about ten days thereafter.

The Carpet Beetle.

Anthrenus scrophulariæ (Linn.).

A very early date for the appearance of this beetle abroad is April twenty-seventh, at which time it was found feeding on the pollen of a Crocus, associated with *Anthrenus varius* Fabr., by Mrs. Hoagland, of Albany. It seemed to show a preference for the white-

flowered Crocus, in which sometimes a half-dozen of the carpet-beetles would be seen at the same time.

An early date for its flight within doors is March sixth, when an example of it was seen floating in the water of an aquarium in my office. It is probable, however, that the beetle may at any time during the winter months, be brought out from its quiet and often protracted repose within its ruptured pupal skin (alike contained within the split larval skin), as it has been observed under such conditions, disclosing segments of its brilliantly-scaled wing-covers, on November eighteenth. A number of our noted household pests, in their perfect domestication, are apparently no longer subjec to stated times for the appearance of their successive broods.

FIG. 38.— The Carpet-beetle, ANTHRENUS SCROPHULARIÆ.

As a Museum Pest.—From a box of unspread *Noctuidæ*, contained in a drawer of the entomological cabinet at the Capitol, two examples of *A. scrophulariæ* and three of *A. varius*, were taken on January 11, 1888; the note made at the time does not state how many of them were alive. The only other instance under my observation of the carpet-beetle as an insect pest, was in finding a living imago, early in January, in association with an *Eumenes fraterna*, upon which it had evidently been feeding and partially consumed.

THE OAK-PRUNER.

Elaphidion parallelum Newm.

Mr. George Theo. Lyman, of Bellport, Suffolk Co., N. Y., writes of an extraordinary increase this year (1887) of this oak-pruner. He had gathered, on his place alone, six large cart-loads of the severed twigs.

Most of the twigs, on examination, were found to contain the larva, but in quite a number it was absent, and in these cases there was a hole in the cut-off end. He was led, from this observation, to question the statement of Harris and others, that the insect transformed within the twig. Reply was made that in these cases, probably, the packing of the burrow in the excised section had been eaten into by some bird or predatory insect, and the larva devoured. That many of the larvæ and pupæ are thus destroyed has been recorded by different writers. Dr. Fitch records that insectivorous birds have frequently been seen industriously picking around the ends of the

twigs lying on the ground, and that doubtless the oak-pruner often falls a prey to these sagacious and diligent foragers.

Mr. Lyman had also observed this present season, at Waltham, Mass., where there are many oaks, the same ravages of this insect as at his home at Bellport, L. I. He had cut open the burrows of many, at Waltham, and had found the grub in most, but it seemed to differ from those at Bellport, in being larger, longer, having a less pointed tail, and a square, blunt head.

He also noticed that some of the twigs, unmistakably cut off by the grub, had no burrow in them, but only a shallow pit of the diameter of a burrow on the severed surface, raising the question, in his mind, whether the grub did not sometimes lose its direction and burrow downward toward the trunk instead of from it.

Oviposition of Saperda candida Fabr.

The following notes, condensed from a communication made by E. W. Junkins, of Carroll Co., N. H., to the *New England Homestead*, of January 3, 1885, are of value as an addition to our knowledge of the habits and life-history of the destructive round-headed apple-tree borer, *Saperda candida:*

A part of a trunk of an apple tree that had been killed by the borers and taken within doors in the early spring, showed, through a crack opened by drying, a pupa of the beetle, on May twentieth. On June eighth it had changed to the beetle (indicating a pupal period of at least nineteen days). Four other specimens that afterward emerged were inclosed in a large glass jar containing wet sand at the bottom, into which were thrust some shoots of an apple tree. The beetles fed upon the tender bark. On June fifteenth, one of the four females was seen depositing an egg. "She first made an incision in the bark close to the sand; then turning head upward, with her ovipositor she placed the egg under the bark nearly a quarter of an inch from the incision, the bark having been started from the wood. July seventh a young borer, three-sixteenths of an inch long, made its appearance. July eleventh, the sticks near the sand were full of eggs, and the beetles were depositing their eggs higher up on the sticks. July eighteenth, one of the borers, three-eighths of an inch long, had worked an inch and a half downward. August seventh, the last beetle died, but would doubtless have lived longer with better care."

On the twenty-sixth of August a beetle was captured among the branches of an apple tree, in the trunk of which eight young borers

were found. The beetle was kept alive for several days and deposited an egg.

This insect is probably known generally to the orchardists in localities where it occurs in injurious numbers, but for the benefit of those

FIG. 39.—The round-headed apple-tree borer, SAPERDA CANDIDA; *a*, the grub or larva; *b*, the pupa; *c*, the imago or beetle.

who may not be familiar with its appearance, representation is given of it in Fig. 39 above.

The above observations of Mr. Junkins are of considerable importance, as they extend the period of oviposition of the beetle much beyond the period heretofore assigned to it, and consequently the time during which the application of soap to the trunk of the apple tree to protect it from the egg-deposit is to be made, will also require a corresponding extension.

Professor Riley has stated:

> The female deposits her eggs during the month of June, and the young worms hatch and commence boring into the bark within a fortnight afterward. * * * Keep the base of every tree in the orchard free from weeds and trash, and apply soap to them during the month of May, and they will not likely be troubled with borers. (*First Report on the Insects of Missouri*, pp. 43, 45.)

Dr. Fitch states as follows in his account of this insect given in his *First Report on the Insects of New York:*

> The beetle makes its appearance every year early in June. * * * In the course of this and the following month the female deposits her eggs (page 13).
>
> Commonly, here in Washington county, they begin to be found upon trees about the twentieth of June, from which time until the close of the month they appear to be more numerous than they are afterward (page 17).
>
> In all orchards where the borer is present, this measure [soap application] should invariably be resorted to the latter part of May, or in more northern localities, where the beetle will be somewhat later in appearance, early in June (page 22).

Referring to Mr. Junkins' observations of the first egg having been deposited after the middle of June, many after July eleventh, and oviposition continued even after the twenty-sixth of August (probably into September), it would seem advisable that the use of the soap application — perhaps our best preventive of the injuries of this pernicious borer — should, in northern New York, not be delayed longer than the first week of June, and should be continued *through the month of July* and into August.

Mr. Charles G. Atkins, of Bucksport, Maine, in a paper read before the Maine State Pomological Society at its last annual meeting, confirms the above observations on the late oviposition of *Saperda candida*. He has found the egg-laying to begin (at his farm in Kennebec county) soon after the middle of June, and to continue until late in August, and had met with unhatched eggs after the first of September.

Mr. Atkins offers the suggestion that relief from this apple-tree borer may be better sought through remedial than preventive measures. With young trees having a smooth bark he would prefer mounding the base to a height of six inches or more with sand, thus compelling the borer to place its eggs where they, or the young larvæ emerging from them and entering the bark, may easily be discovered by proper inspection and destroyed. (*Home Farm*, March 5, 1885.)

Orthaltica copalina (Fabr.).

Numbers of this beetle were observed at Schoharie, N. Y., on July sixth, feeding on the leaves of *Rhus typhina*. It was the first time that the species had been noticed by me upon this plant. Many of the beetles were paired, while others were engaged in feeding on the lower surface of the leaves which they eat away, causing them to dry up and shrivel as if from the effect of heat.

This species belongs to the *Chrysomelidæ*, and to the group *Crepidoderæ*. In systematic arrangement it comes next to *Epitrix*, and is, therefore, closely allied to the well-known cucumber flea-beetle, *Epitrix cucumeris* (Harris), which at the present time is so injurious to the potato crop in the State of New York.

In the sixth Missouri report, Professor Riley has given illustration, the life-history, etc., of another sumach-feeding Chrysomelid, *Blapharida rhois* (Forst.), which he designates as the "jumping sumach beetle." It feeds readily on all of our indigenous sumachs, and in some years completely denudes them over large tracts of territory.

THE CLOVER-LEAF WEEVIL DESTROYED BY A FUNGUS ATTACK.

Phytonomus punctatus (Fabr.) — *Entomophthora Phytonomi* Arthur.

During the latter part of May, 1885, some larvæ were received from Dr. E. L. Sturtevant, which had been taken from the grounds of the New York Agricultural Experiment Station, at Geneva, and had evidently been killed by a fungus attack. The larvæ were found attached to, and coiled around, the tips of blades of grass, dead, stiffened, shrunken, and partly covered with a whitish fungus. From a careful examination of the larvæ, it seemed probable that they were immature forms of the punctured clover-leaf weevil, *Phytonomus punctatus*. The beetle is shown in Fig. 40, in twice its natural size.

Other examples of the larvæ were received from the same source, on November third, in the same condition with those previously sent. Not being positive of my determination of the species, request was made for living examples, to be sought for buried beneath the surface of the ground, or while feeding at night, but they could not be obtained. Some of the material was, therefore, sent to the Entomological Division of the Department of Agriculture at Washington, where it was compared with alcoholic specimens, and was found, from the structure and markings of the head of the larva, to be, beyond doubt, that of *Phytonomus punctatus*.

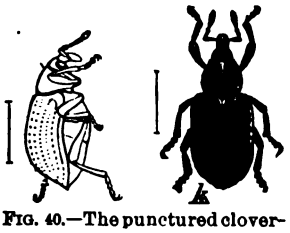

FIG. 40.—The punctured clover-leaf weevil, PHYTONOMUS PUNCTATUS; dorsal and side views.

Dr. Sturtevant having suggested the possibility that the fungus attack may have been the result of the fertilizer used at the station, the fungus was shown to Prof. Peck, the New York State Botanist. It was pronounced by him, in all probability, an undescribed species, allied to the well-known fly-fungus, *Empusa muscæ*.

On mentioning the above facts to Hon. G. W. Clinton, he expressed his belief that the fungus may have been communicated in the manner suggested by Dr. Sturtevant, if fish-remains entered into the composition of the fertilizer, from the fact that a common fungus found infesting fishes is the *Saprolegnia ferax*, which is believed to be but the aquatic form of the *Empusa muscæ*.

The above was communicated to Dr. Sturtevant, with an inquiry of the nature of the fertilizer that had been used. Answer was returned that he had obtained from the manufacturers the formula of its composition, and that "the nitrogenous material was supplied by *acidulated fish-skins*, dried ground horse-meat and western blood."

If, as seems not improbable, the death through fungoid attack of the larvæ, may be shown to be the result of the use of the fertilizer, either through the discovery of the same fungus in the fertilizer, or,

better still, by experiments with healthy larvæ — the mortality of the larvæ observed at Geneva, by Dr. Sturtevant, will certainly be an event of unusual interest. It would appear to give us the means of destroying a pest which, up to the present, it has not been possible to control, while, at the same time, stimulating the infested crop and thereby enabling it the better to resist all other forms of insect attack. Nor would its efficacy be limited to this particular species, but it would be doubtless available against many other insect enemies, especially those that burrow in the ground, after the manner of the *Phytonomus.*

The fungus attack was subsequently studied by Professor J. C. Arthur, Botanist of the Experiment Station, and his report upon the same may be found in the Fourth Annual Report of the Station, 1886, pp. 258–262. It is there fully described by him, and also illustrated in four figures, under the name of *Entomophthora Phytonomi.* The following extract is made of the conduct of the infested larvæ and their appearance under the attack:

The sick larvæ of all ages crawl up the herbage during the night, and instead of again concealing themselves near the ground on the approach of light, as the healthy ones do, ascend as high as possible, and, if on grass, coil themselves in a horizontal position about the apex of the blade, as in Fig. 41, or if on other objects, take a position as nearly similar as the shape of the object permits. If disturbed before the middle of the forenoon, the majority are still able to crawl, although sluggishly: by noon most of them are quite dead, but unchanged in appearance. It will be found that they cling to the leaf with greater tenacity than during life. Examining the under sides of the body will disclose the fact that delicate, colorless holdfast have grown out from the median line, which, attaching themselves to the leaf, hold the insect firmly in place. Late in afternoon the body has changed from the normal yellowish or pea-green and smooth appearance to velvety-gray. The next morning there is only a small blackened and shriveled mass remaining, while the surrounding foliage is powdered with a whitish, clinging dust, composed of the spores of the fungus. * * * This is the general course of the rapid and fatal disease.

FIG. 41.—Fungus-attacked larva of PHYTONOMUS PUNCTATUS coiled about the tip of a blade of grass. Enlarged five diameters.

In 1886 and 1887 the insect did not appear on the grounds of the station in sufficient number to invite attention, and no further observations were made on the fungus attack.

PŒCILOCAPSUS LINEATUS (Fabr.).

From Mr. E. S. Goff, of the N. Y. Experiment Station, some Hemiptera, in their larval and pupal stages, feeding in the garden of the station upon sage, *Salvia officinalis,* were received June 1, 1885.

The larvæ were broadly elliptical. Head testaceous; eyes black; first joint of the antennæ testaceous, second joint pale basally, and the others pale at the joints. Thorax testaceous anteriorly, with two black spots on its hind margin, separated by a pale mesial line. Abdomen red, with eight transverse dorsal lines, broken mesially by a pale line; the rudimentary wing-pads black. Legs pale; femora darker above; tibiæ brown-spotted.

Pupæ.—Wing-pads more than one-half as long as the abdomen, shining black, with a broad whitish longitudinal line from their base, but not reaching the tip near their outer margin; this line continued in yellow upon the thorax, dividing each lateral black spot into two—the outer one being simply a marginal line. A yellowish dorsal line from the thorax over the abdomen; segments black except on their posterior margin and at their sides; femora with two black rings.

The imago from the above appeared on June thirteenth, in three examples, and proved to be the species named above, and commonly known as the "Four-lined leaf-bug." They were the variety *b*, described by Dr. Fitch as wanting the black dot at the end of the outer black stripe on the wing-covers, on the triangular piece marked off by a suture before the membranous tip. As the three examples were females, it was thought that the absence of the black spot might be a sexual feature, or possibly certain broods might be thus characterized. In accordance with a request made to Mr. Goff, a number of examples from the garden at the Experiment Station were sent to me. It was found from them that the spot gave no special indication, as of the thirteen males received seven were without the spot, and of the seven females, two.

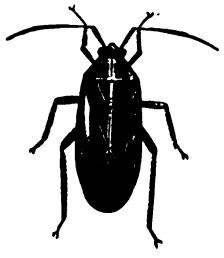

FIG. 42.—The four-lined leaf-bug POECILOCAPSUS LINEATUS, three times the natural size.

Mr. Goff stated that for the past three years this insect had appeared in very nearly the same place in the garden, but in somewhat greater numbers the present season. Last year (in 1884) it made a serious attack upon gooseberry bushes at the Experiment Station, depleting the tips of the young growth, so that they shriveled, wilted down and died. It was also received from Batavia, N. Y., as injuring sage in a garden.

While so abundant and destructive in my own garden in 1881 (see *First Rept. Insects N. Y.*, p. 271), it has not been injurious since, although examples of it have been observed each year, feeding on the black currant, *Ribes nigrum*.

Attack on Young Pears by a Plant-bug.

Messrs. Ellwanger & Barry, of the Mount Hope Nurseries at Rochester, N. Y., have sent me under date of June 19, 1884, some specimens of young pears, blotched and injured, together with insects taken upon them.

Some of the pears, of about one-half inch in diameter, show as many as forty blotches from an eighth of an inch in diameter downward. From the minute puncture originally made, the juice as it has escaped has become hardened and granulated, and with its increase has split the skin in different directions, often in a triangular form or one wound running into another. The more seriously injured pears would be rendered unfit for sale from their knotted surface, even if after such a drain upon them they should continue upon the tree, which is not at all probable.

The insects taken upon the injured fruit were the tarnished plant-bug, *Lygus pratensis* (Linn.). Although they were not actually observed feeding upon the juices, there can be no reasonable doubt of their being the authors of the injury. This form of attack (upon the fruit) has not been previously recorded, yet their fondness for the blossoms of the pear is known, and they are also known to be destructive to the fruit of the strawberry.

Fig. 43.—The Tarnished plant-bug, Lygus pratensis.

In the attack above recorded, the insect has apparently shown a preference in the variety of pear it has selected. Messrs. Ellwanger & Barry write: "The whole of the fruit in one of our orchards on the Duchesse d'Angouleme trees is affected; while on the Beurre d'Anjou and other varieties, we find nothing of the kind."

In the *American Entomologist*, ii, 1870, and in the *First Report on the Insects of New York*, 1882, statement is made of a pear orchard having been saved from the destruction of its blossom buds by this insect, by shaking them from the branches into a vessel of soap-suds, for three successive mornings. If equally effective in other instances of attack, it will prove a valuable remedy, for its control is often quite difficult, if not impossible.

This destructive plant-bug, of wide distribution over the United States, and of very injurious habits from its broad range of food-plants, has long been known as *Lygus lineolaris* Pal. Beauv., and has been but recently referred to the species described as *pratensis* by Linnæus.

AN EXPERIMENT WITH THE THIRTEEN-YEAR CICADA.

The following paper was read before the Albany Institute at its meeting on October 6, 1885, with a view of making record of the planting of a brood of the "thirteen-year locust," at Kenwood, near Albany, and of the request that observations be made of the appearance of the winged insect at the time that its development may be expected:

"It is probably known to all the members of the Institute that notwithstanding the rapidity of multiplication in the insect world — very few of the species requiring more than a year for their life-cycle, and many having several generations in the year — one species requires seventeen years for its development from the egg to the perfect insect, viz., the seventeen-year Cicada, or the *Cicada septendecim*. That so exceptional a life-period is still doubted by many is not strange, in view of the fact that the Cicadas are seen to appear at shorter intervals than seventeen years — indeed, almost every year witnesses their appearance in some part of the United States. But this admits of easy and satisfactory explanation. There are a number of distinct broods occurring within the United States — no less than twenty-one are known — having each its geographical limits, sometimes overlapping one another, but each ever true to its seventeen-year period. Within the State of New York we have five of these broods, one of which made its appearance on Long Island during the past summer, in immense numbers, and another will appear also on Long Island in 1889.

"Besides this seventeen-year Cicada, Prof. Riley has also discovered the existence of a thirteen-year Cicada.

"No specific differences in appearance between these two forms can be detected, for which reason the latter is not accepted as a distinct species, but is regarded only as a form or race. The thirteen-year Cicada is a southern form, which, in its northern extension, does not reach further than into the southern part of Illinois. We do not have it in the State of New York.

"In the possibility that this short-period southern form may, in the lapse of time, have been developed from the normal seventeen-year race, as a consequence of the higher temperature of the Southern States hastening its development, Prof. Riley has, the present year, undertaken to test the effect of climate on the permanency of the two races, by transferring them from one region to the other. He thinks it possible that a southern brood brought northward might fail to appear at the expiration of thirteen years, and a northern brood taken south, might appear in a less time than seventeen years.

"Offering to him my assistance in the interesting experiment, he has sent to me a quantity of apple twigs from Mississippi, filled with the eggs of the thirteen-year Cicada, with the request that I would place them in an orchard where the result of the experiment could be observed at the proper time, and that I would also have proper record made of the same.

"I, therefore, ask place in some publication of the institute, for the statement that the orchard of Mr. Erastus Corning, at Kenwood, was selected for the planting of the eggs, from the considerations that it was a young orchard, that it promised permanency for the desired time, and that no other brood of Cicada would occur there with which this could be confounded. The tree beneath which the eggs were placed (they were hatching at the time, and the twigs containing them set about the base of the tree, and tied to its lower branches) was marked with a zinc label, bearing this inscription:

"'*Thirteen-year brood of Cicada (Riley's Brood, No. VII) — eggs from Oxford, Mississippi, planted July* 4, 1885.'

"Additional eggs from a second sending were placed beneath the same tree on July twenty-first, and also some in a wood adjoining, a few rods toward the south, to serve as a food-supply in the event of the death or destruction of the orchard.

"As I may hardly hope to see the result of this experiment, may I beg of some of the members of the Institute who are interested in Natural History, that *in the month of June*, 1898, they will make examination of the labeled tree and trees adjoining, for the pupa cases of the Cicada that should be found upon the trunks, if still obedient to their thirteen-year period, and for the insects in the vicinity, which should easily be discovered, if present, by their well-known song, which would readily reach the ear. Should they fail to appear at the time designated, then the search for them should be renewed the following year, and, if need be, for successive two or three years, until their appearance.

"The result of the observations should be communicated to the Entomological Division of the Department of Agriculture at Washington, unless it should be known that full examination had already been made by an agent delegated for the purpose from the department.

"In the planting of the eggs I was assisted by Mr. William Grey, gardener of Mr. Erastus Corning, who has been requested to communicate to others upon the farm the location of the tree in order that there may be no difficulty in finding the locality at the desired time.

"In addition to the above, other transfers of the eggs of the thirteen-year Cicada from Mississippi, have been made, to Ithaca, N. Y.;

Boston, Mass.; Kittery Point, Me.; Brunswick, Me.; and Ames, Iowa, as noticed in *Entomologica Americana*, for August, 1885, vol. 1, p. 96. Similar transfers, under direction of Professor Riley, of eggs of the seventeen-year Cicada, have been made the present year from Indiana, Michigan and Pennsylvania, to localities in Alabama, Georgia, Mississippi and Missouri."

[For a subsequent notice of the above series of experiments, see Professor Riley's report to the Department of Agriculture, for the year 1885, pp. 254–257.]

WHITE SCALE-INSECT ATTACK ON IVY.

Aspidiotus nerii Bouché.

The following note of inquiry in relation to a quite common insect attack of the ivy has been received from a lady in Watervliet, N. Y.:

"Inclosed please find a leaf of ivy. Will you kindly inform me of the cause of its peculiar appearance, and also the remedy, if any? The leaf and stem are alike infested, and the whole is in an unhealthy condition."

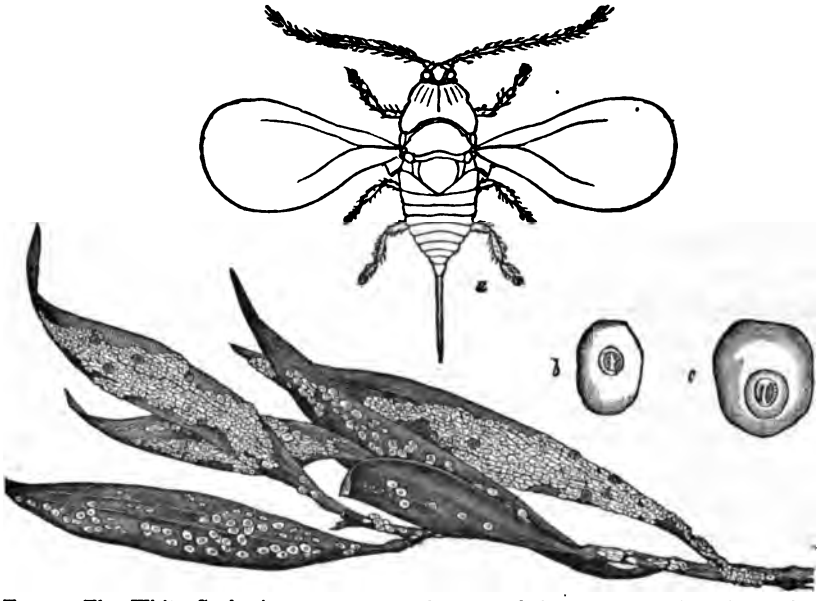

FIG. 44.—The White Scale, ASPIDIOTUS NERII, in natural size, on an acacia twig: *a*, the winged male insect; *b*, the male scale; *c*, the female scale—each enlarged.

Reply was made that the leaf sent for examination showed upon both surfaces, clustering about the veins and more thinly distributed elsewhere, and upon the leaf-stalk, many whitish, rounded, slightly

convex spots, varying in size from almost microscopic to nearly as large as the head of a common pin. Examined under a lens, their peculiar elevated centers show them to be a species of scale-insect, known as *Aspidiotus nerii* Bouché [represented in the accompanying figure]. It is quite a common species upon the oleander, from which its specific name has been taken. Prof. Comstock in his notice of it — *Second Report in the Department of Entomology of the Cornell University Experiment Station*, 1883, states that it is generally distributed throughout the United States, and occurs upon the cherry, plum, currant, English ivy, maple, upon lemons from the Mediterranean, etc. These scale-insects are very injurious to the ivy when they attack it, for multiplying rapidly, their immense number make such a draft upon the juices of the plant that it can not long withstand the drain. On the first notice of the scales, their spread should be checked, if possible. If the plant is small, each leaf should be separately treated, by scraping the scales from them, or washing them with a strong soap solution, or a kerosene emulsion.

To larger plants the application would have to be made by sprinkling or by spraying with a force-pump.

By far the best time to attack the insect is when the young are first hatched and have crept out from beneath the sheltering scales. From their minuteness this could only be ascertained by the aid of a magnifying glass, under which they would appear as small dots slowly moving over the surface of the leaf. At this stage they could be killed by a solution of one pound of soap (strong rosin soap) in two gallons of water.

If not convenient to wait and watch for this phase of the insects' life, they may be killed at any time while in the egg stage beneath the scales by a kerosene and soap emulsion prepared as follows:

Dissolve one pound of rosin soap, in one quart of boiling water; add gradually one quart of kerosene, with constant stirring, until emulsified. The result will be a gelatinous compound consisting of fifty per cent of kerosene. This emulsion diluted, when used, with two gallons of water, would give a solution containing ten per cent of kerosene, which, if properly distributed so as to reach all of the scales, should be of sufficient strength to destroy the eggs without injury to the plant. [This formula is nearly the same as that given on page 262.]

The season at which the young insects hatch upon in-door plants depends upon the temperature of the room, but would ordinarily be during the latter part of winter.

The Black-knot of the Plum-tree and its Guests.

A piece of a limb of a plum-tree having the well-known "black knot" upon it was received in July, with the inquiry of the kind of insect that caused its growth, and if there was any remedy for the attack. The tree from which the piece was taken was wholly free from it, it was stated, in the spring.

It is a popular belief that the black-knot, so common on plum and cherry trees, and which causes annually the death of thousands of these trees throughout the United States, is produced by an insect attack. There is some foundation for this belief in the fact that insect larvæ are frequently found within the knot. These, however, are not the cause of the obnoxious growth, but merely enter it for food or shelter during its early formation.

The common plum curculio, *Conotrachelus nenuphar*, which is so destructive to the fruit of the plum-tree, has been bred by Dr. Fitch, Mr. Walsh, and others, from larvæ inhabiting the black-knot. Mr. Walsh has also bred from it five other species of insects — two of flies, viz.: *Ceratopogon* sp. and *Diplosis septemmaculata* Walsh, and three species of small moths, referred with doubt to the genus *Hedya* (*Practical Entomologist*, i, p. 50). Larvæ have on different occasions been taken by me from their cocoons made upon the margin of the black-knot, where it was overgrowing an excision of the preceding year, and the empty pupa-cases of evidently the same moth have been seen protruding from the knot. The moth, unfortunately, was not obtained, but it was probably that of *Ægeria pictipes* Grote-Rob., which is known to infest plum-trees sometimes in great numbers (*North American Entomologist*, i, 1879, pp. 17–21, with plate).

Although it is not many years since the origin of the black-knot was in doubt, for even in 1859, Dr. Fitch pronounced it not a fungus (*Trans. N. Y. State Agricultural Society for* 1859, xix, p. 606), it is now known to be a fungus growth of a species long ago described and named as *Sphæria morbosa* Schw. Quite recently it has been transferred to the genus *Plowrightia*, and this later generic name will probably ere long be generally accepted.

The specimen sent is of a brown color, for it is not until late in July or about the first of August that it presents its well-known black appearance, caused by "numerous coal-black hemispherical plates of about the size of the head of a pin, each of which is a distinct fungus."

Professor Riley has quoted Mr. Walsh as having shown that the black-knot fungus infesting the cultivated cherry "was quite distinct from that attacking the cultivated plums." He has also indicated another species occurring upon the "Miner plum," which may be seen "at a single glance to be essentially distinct from the common black-knot

of the plum." He writes: "It would seem to follow that there are three distinct black-knots, originating, respectively, from choke-cherry, from the common wild plum and from the Chickasaw plum." (*American Entomologist*, ii, 1870, p. 231.)

Those who have studied this fungus the most thoroughly believe in the existence of but one species, which readily transfers itself from the plum to the cherry, and the reverse. According to Professor Peck, New York State Botanist, "it is now known to occur on *Prunus domestica, P. Americana, P. cerasus, P. Virginiana, P. Pennsylvanica*, and *P. serotina*. Two of these are plum trees — one introduced, the other native — and the remaining four are cherry trees, of which the last three are indigenous" (*Thirty-first Report of the N. Y. State Museum of Natural History*, 1879, p. 60*).

Remedy.

The only remedy, so far as known, for the black-knot, is the free use of the knife as early as possible after its discovery. Mr. Walsh has emphasized the following as the remedy that may be relied on: "If the diseased twigs are cut off and destroyed early in July in the latitude of New York, or a little earlier or later according to the latitude, taking care to cut a few inches below the affected part, the black-knot can be checked and probably entirely eradicated; but if this operation is delayed until August, it will be of no benefit whatever."

If the above remedy is resorted to in the early stage of growth the limb or twig need not be removed, but the fungus can be cut out with a sharp knife while still confined to one side of the branch, permitting, if properly done, the wound to heal in a short time.

Those who experience difficulty in arresting the spread of the black-knot should avail themselves of the information contained in a paper entitled "Black-knot — Cause and Remedy," by Professor C. H. Peck, published in the *Country Gentleman* for June 28, 1888 (vol. liii, page 485). No paper of higher practical value has ever been published on the subject.

Collections in the Adirondack Region, et al.

[From the Report of the Entomologist to the Regents of the University for 1883, published in the Thirty-seventh Annual Report of the New York State Museum of Natural History.]

The collections [for the year 1883] have mainly been made in Middleburgh, Schoharie county; at Elk lake, in Essex county; in the town of Hammond, St. Lawrence county; and in Albany.

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*In addition to the species herein named, I have also observed it abundantly on the sand plum, *Prunus maratima*, on Coney Island.

Among those at Middleburgh were a number of *Trypetdiæ*, of the group in which the wings are exquisitely marked with clouds and spots in the beautiful patterns so admirably delineated in the four plates of Baron Osten Sacken, and the late Dr. Loew, of Prussia, in their valuable Monographs of this interesting family. These flies had seldom fallen under my observation before, and then in only single examples; but at this time (middle of July) and place they were not at all uncommon, traveling, with the strange movements peculiar to them, over the leaves and stalks of the milkweed (*Asclepias cornuti*) and wild parsnip (*Pastinaca sativa*), within which the species may perhaps breed.

The time of my visit to Elk lake — August fifteenth to thirtieth — was favorable for the collection of two species of butterflies which are rarely met with in this State, except in localities having high elevations, approximating that of Elk lake, which is 2,000 feet above tide. *Grapta Faunus* (Edw.) and *Grapta j-album* (Boisd.-Lec.) were comparatively abundant in the roadway leading to the lake, resting for a while upon the damp soil to imbibe its moisture and then flitting away to the adjoining shrubbery. Both species had evidently but just emerged from their pupal stage. Of another species of butterfly, *Feniseca Tarquinius* (Fabr.), which appears to be quite local in its distribution and to occur more frequently within this State, in the Adirondack region than elsewhere, several examples were captured, but all in indifferent condition, showing that they had already been abroad for a number of days. Its larval food-plant was said by Mr. Glover to be hawthorn (*Cratægus*),* but in this and in both previous instances in which the butterfly has been observed by me, it has been associated with alders (*Alnus* species), and where the hawthorn was not seen to occur.

An interesting illustration of the abundance at times and in certain localities of a particular species of insect, conjoined with the absence of other allied and perhaps more common forms, was given me at this locality. With a single exception, in a solitary example of *Catocala unijuga* Walker, the only noctuid moth observed during my fortnight's sojourn here was *Agrotis clandestina* (Harris). To add to the interest, all the examples had one common hiding-place, viz., behind and about the sliding window-sashes of the exceedingly simple log structure that was dignified with the name of the Elk Lake Hotel. The only conceivable attraction of such a multitude of moths to their covert was a single kerosene hand-lamp, and later at night for a brief

* The larva has since been found to feed on the woolly plant-lice that occur in large clusters on the trunks and limbs of Alders: See *4th Rept. Ins. N. Y.*, 1888, p. 179.

space of time, a candle in each of the four bed-rooms. Their assemblage in such numbers, under such circumstances, was a mystery to me. A sash could not be moved without disturbing a dozen of them. Hundreds could have been captured, but as many were in poor condition and the species is a common one, twenty-five examples only were brought away.

The black-fly, *Simulium molestum*, was abundant, but not very troublesome, for in the month of August it ceases to show the insatiable disposition to gorge itself with blood that it manifests in the preceding months.* A number of specimens were captured and bottled for the Museum collections as objects of interest to the many who have never recognized this minute yet most annoying pest of our Northern Wilderness.

Upon some cut poplars (*Populus tremuloides*) piled by the way-side, a large number of a wood-boring beetle, *Agrilus torpidus* Lec., which I had never met with before, were observed alighting from their flight in the bright sunshine, and running actively, in jerking motions, over the bark. Sixty-two examples of it were taken. Its larva is probably a borer in the poplar.

COLLECTIONS IN THE ADIRONDACK REGION IN 1885.

[From the Report of the Entomologist to the Regents of the University for 1885. Published in the Thirth-ninth Annual Report of the New York State Museum of Natural History.]

About three weeks in the month of August were devoted to collections in the Adirondack region, at Long lake, in the northern part of Hamilton county, N. Y. The altitude of the lake is 1,632 feet above tide. This elevation is too great to admit of an abundance of insect life, while it fails to reward the collector with the rare forms which are to be met with at higher elevations — at and above 2,500 feet.

Very little is known, as yet, of the insect fauna of this interesting portion of our State. As I have previously written, "The enthusiasm of the entomologists of an adjoining State has led them to explorations of a peculiarly interesting field lying beyond the limits of their own State — the White Mountains of New Hampshire. For successive years the members of the Cambridge Entomological Club have established a midsummer encampment upon the slope of

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* The guides of this region have a familiar saying, that "the black-fly doesn't bite after it has put on its white stockings," referring to the white bands upon its legs. Probably this is a different species and more blood-thirsty than the form that abounds earlier in the season and not thus marked. Unfortunately, the black-flies of the Adirondacks have not been studied, and *Simulium molestum* is only a manuscript name.

Mt. Washington, during which, through their protracted sojourn of weeks, and opportunity for collecting crepuscular and nocturnal forms, they have been able to enrich their cabinets, and those of their correspondents, with many rare boreal species, to accumulate much valuable biological information, and to present local lists of Lepidoptera, Coleoptera, and Orthoptera, which have been received as special contributions to science.

"Meanwhile the extensive Adirondack region, with its numerous lofty mountain peaks, its deep gorges, its hundreds of lakes — perhaps second only to the White mountains in point of interest to the entomologist of any locality in the United States east of the Rocky mountains — has been permitted, year after year, to bury within itself its entire entomological wealth. Previous to the collections noticed in this paper [*Lepidoptera of the Adirondack Region* *], hardly an insect had been drawn from it. At the present nothing has been reported of its mountain insect fauna. Many new species are undoubtedly to be discovered there, and the first comparison of its fauna with that of other elevated and more northern regions is yet to be made.

"It is sincerely to be hoped that, from the growing interest manifested in entomology, the numerous accessions to the number of its students, the facility for study afforded by recent publications and in several extensive classified collections, the reproach resting on the entomologists of New York may speedily be removed. And while the thorough exploration of any locality can scarcely fail of bringing to light much new material, the ambitious student may have for his incentive the assurance that in the Adirondack mountains there is open to him an unexplored field where faithful search will assuredly yield him a most abundant return."

The locality of Long lake and the season offered but few flowering plants for the attraction of insects. The collections, therefore, were mostly confined to golden rods (*Solidago*) and the hard-hack (*Spiræa tomentosa*), which were freely visited by Hymenoptera, Diptera, and Coleoptera for the pollen that they afforded.

Of the Hymenoptera, the flowers were especially prolific in *Apidæ*, *Andrenidæ*, *Eumenidæ*, and *Crabonidæ*, whilst also yielding some desirable *Ichneumonidæ*.

In Diptera, several species of the gaily-colored *Syrphidæ* (flower flies) were abundant, of which, perhaps, the most interesting form was *Spilomyia fusca* Loew — a large fly, so singularly mimicking in size,

* *Seventh Annual Report of the Topographical Survey of the Adirondack Region of New York*, 1880, pp. 375-400.

form, color, and markings the common "bald-faced hornet," *Vespa maculata* Linn., as to be easily (and generally by other than entomologists) mistaken for it. The species had never come under my observation before, nor has it been recorded as occurring in the State of New York. Its first capture was made on the eleventh of August. It continued to increase in number, in both sexes, and the day prior to my departure from the locality (twenty-third inst.) it was more abundant than before. Over forty examples of the species were taken. Nothing, I believe, is known of its larval stage. Several examples of an interesting Conopid fly, *Physocephala furcillata* Williston, which had previously been taken only on the White mountains, were also captured on the *Solidago*. A large, globose-bodied Tachinid fly, *Echinomyia* sp., having its alulæ and basal portion of wings of a dull yellow, which I had in former years observed abundantly in Essex county, N. Y., was also a common visitor to the blossoms of the golden rod.

The collections in Lepidoptera were not large, the locality not being favorable to the multiplication of insects of this order. But few species of butterflies were seen, the following species being the only ones that were observed: *Colias Philodice* and *Pieris rapæ*, not abundant; *Danais Archippus*, abundant; *Argynnis Cybele*, *A. Aphrodite* and *A. Atlantis*, all in poor condition; *Argynnis Bellona*, not abundant; *Pyrameis Atalanta* abundant; *Satyrus Nephele*, rare; *Chrysophanus Americana*, very abundant, and frequent on golden rods; *Lycæna pseudargiolus*, rare, one example; *Vanessa Milbertii*, a few: no examples were seen of *Papilio*, *Grapta*, *Pamphila*, or *Nisoniades*. Of the above named, *Danais Archippus* (Fabr.) and *Pyrameis Atalanta* (Linn.) were so abundant in a field of buckwheat that three or four individuals could be taken in a single sweep of the net. Associated with them were numbers of one of the most brilliant and beautiful of our moths, *Plusia mortuorum* Guenée — a decidedly upland species. Its quick rise from the blossoms of the buckwheat, its rapid flight for a short distance, sudden dropping to the ground and running away to shelter, made it a difficult insect to capture. The elegantly marked *Homohadena atrifasciata* Morr., of which the first example taken in the Adirondacks in the year 1876, commanded in exchange with an enthusiastic lepidopterist, other insects of the value of fifty dollars, was taken from flowers of *Eupatorium purpureum*.

Coleoptera were not numerous. Several species of the pretty Lepturians were found upon the golden rods, and a single example of "the large and elegant *Leptura scalaris* Say," as characterized by Dr. LeConte (p. 313 of *Classification of the Coleoptera of North America*), now the type and only species of the genus *Bellamira*, was driven up

in a Solidago bordered road and taken upon the wing. It was seen under the same circumstances in other instances, and when in flight, and displaying the golden sericeous hairs clothing the tip of its abdomen, it resembled so closely a similarly tipped Asilus fly that it was mistaken for it. *Dicerca manca* LeC. (apparently not *tuberculata* of L. & G.—see *Trans. Amer. Ent. Soc.*, ix, p. 235), a rare Buprestid, was captured on the floor of the piazza of the Sagamore hotel.

Neuroptera, which should abound in the lake region, were few in number. The only species observed in abundance were the common *Polystœchotes punctatus* (Fabr.), of which hundreds could be seen resting on the parlor walls, and an Ephemerid, *Pentagonia vittigera* Walsh, on the slats of the window blinds and edge of the clapboards of the hotel.

About 1,000 insects were collected, mounted and labeled with locality and date of capture.

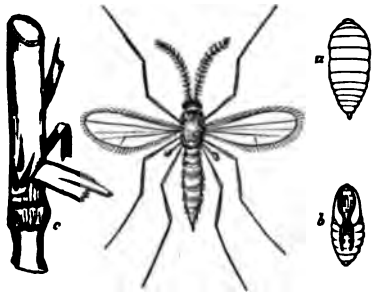

FIG. 45.— The Hessian-fly.

ACARINA AND MYRIOPODA.

A Mite Attack on Garden Plants.

Leaves of various garden plants showing a mite attack upon them were received in September, from Miss A. Goodrich, of Utica, N. Y., with the following note.

For two years past I have often found the leaves of the *Calla* covered with fine webs spun by a small mite. Last year garden plants were affected. Leaves turned yellow and flowers did not open. One root of *Spiræa* was almost killed. I put it in a pail of warm suds for the night, and planted it in a new place next day. This year it was not so badly attacked, but the sweet English violets and the *Thunbergia* in my window boxes suffered most. I tried hot water of 120° Fahrenheit, on the violets with success. I send specimens of the mite.

The mite is that frequent pest of garden plants and conservatories, *Tetranychus telarius* (Linn.), commonly known as the "red spider." It owes its popular name to its habit of spinning a web, and to the brick-red color which it sometimes assumes — the color which so often brings it under the notice of horticulturists. It may, however, present a great variety of shades of green, brown, and red, dependent to quite an extent upon its food-plants, although occasionally found to offer different colors upon the same plant. Fig. 46, after Claparède, represents it at maturity, greatly enlarged.

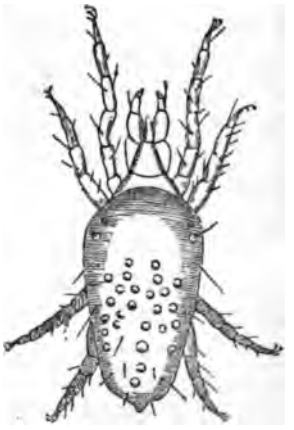

Fig. 46. — The "red spider," Tetranychus telarius — enlarged.

Although generally known as a spider, it is a true mite. In classification it stands next to the spiders, and at the head of the mites, in the family of the *Trombididæ*, which contains the most highly organized species of the Acarina. A distinction available in separating the mites from the spiders is that the former are without a pedunculated abdomen. The abdomen instead of being joined to a thorax by a narrow joint of attachment is united to the last of the leg-bearing segments without any well-defined groove of separation.

The webs which this species and its associates spin on the under side of leaves and adhering closely to them, are of an extremely

fine and delicate texture. A careless observer would not suspect their true character, but would pass them by as a simple sheen upon the leaf. The separate threads are so fine that they are not to be seen even by the aid of a magnifying glass, but are only visible when combined in an extended web. The silk is secreted from a minute nipple underneath the end of the abdomen. Beneath the web may often be found a large colony of the mites, embracing both old and young, in different stages of maturity, where, under this safe shelter, they are actively engaged in feeding upon the leaf. After biting with the mandibles with which they are provided, through the surface of the leaf, they insert the sucking apparatus and imbibe the juices. Small as is each individual wound, the aggregation of the myriads soon tells upon the leaf and plant, which discolors, droops, turns yellow and perhaps dies under the attack.

It is unfortunate that this insect is so general in its food, for scarcely any tender garden plant is free from liability to its attack. In addition to the *Calla*, *Spiræa*, *Thunbergia* and violet, above-named, it was also present upon the leaves of *Mitella*, *Tropæolum*, *Adlumia*, and beans, sent with the inquiry. Their examination by Prof. Herbert Osborn, to whom they were submitted, showed the presence upon each of the same insect, in the egg, larval, and perfect stages.

This little mite, under favoring conditions, may multiply to an incredible extent, and become very injurious. A notable instance of this has lately been brought to my notice. Leaves of a quince tree infested by this species were sent to me for name, under date of August eleventh, by Prof. Arthur of the New York Agricultural Experiment Station, at Geneva. He reports the attack as occurring in one of the largest quince orchards in the State, about four miles from Geneva. The leaves upon many of the trees were like those received by me, which were nearly destroyed. The attack was rapidly spreading throughout the orchard, and the fruit upon the most seriously infested trees would be an entire loss.

Prof. Arthur was experimenting with the kerosene emulsion to kill the insect, but with what success has not been learned. Properly applied, it could not fail of accomplishing the purpose. A favorite remedy, long used in green-houses, is syringing with a soap solution in which sulphur is mixed. Quassia has also been thought serviceable when added to the mixture. It is quite important that the liquid be so applied as to reach the under surface of the leaves where the mites occur. It is worthy of note that in the above quince attack most of the mites were observable upon the upper side of the leaves.

The attack of this little mite is undoubtedly far more frequent than is supposed, for the reason that the creature can hardly be seen with the naked eye, and an ordinary pocket magnifier only shows it as an animated speck. A nasturtium in my garden, which had been for some time showing yellow leaves, or yellow blotches upon the leaves, without any apparent cause, was found, upon examination for this mite, to show its presence in considerable numbers, in the larval and in the adult stages. As an experiment, one of the infested leaves was dipped in water in which some soap had been stirred, with the result of speedily killing all of the mites upon it.

A Parasitic Mite of a Sexton Beetle.

Dr. S. A. Russell, of Albany, N. Y., has sent to me an example of one of the burying or "sexton beetles," *Necrophorus tomentosus* Web. (distinguishable from the other red-banded members of the family by the greenish-yellow down covering its thorax, and the two red bands crossing its wing-covers), thickly infested with a small red mite which runs with great rapidity. Several of them were sent to Prof. Osborn, who is making a special study of our mites with reference to a catalogue of the known species. At this present stage of his studies, he was only able to refer it to the genus *Gamasus*. He had previously obtained the same form from another species of *Necrophorus*.

Fig. 47. — The tomentose sexton-beetle. Necrophorus tomentosus.

[The catalogue — *A Preliminary List of the Acarina of North America*, by Herbert Osborn, of the Iowa Agricultural College, and Lucien M. Underwood, of Syracuse University — has been published in the *Canadian Entomologist*, for January, 1886, xviii, pp. 4–12].

A Parasitic Attack on the Colorado Potato-beetle.

From a gentleman in Middlesex county, Mass., some live potato-beetles, *Doryphora decemlineata* (Say), were received, to which were attached numbers of "bugs or lice," with the statement that he had found many of the dead beetles thus infested, and only a few live ones that were not attacked, and it seemed as if the beetles would all be killed.

The supposed lice proved to be a very interesting parasite which has been known for several years past to attack the Colorado potato-

beetle, and, as in the present instance, to render valuable service in reducing the numbers of this pest. Its principal interest, perhaps, is in the fact that, up to the present, only two or three true parasites of this beetle have been discovered among its thirty or more known natural enemies.

As an aid in the recognition of this parasite, it may be stated that they are quite minute forms, as five of them placed closely together would not exceed in surface that of the head of an ordinary pin. Their color is yellowish-brown, and in general shape they resemble many of the lady-bugs (*Coccinellidæ*), being oval, flat beneath and convex above. When examined with a microscope, they are found to possess eight legs, and this feature, of course, removes them from the lice and all other true insects, which have but six legs.

Their scientific classification places them among the Arachnoidea, in which are included scorpions, spiders, and mites. As their body consists of but one piece, instead of being made up of several segments, they fall in the last-named order, the mites (*Acarina*). This order embraces a large number of greatly differing forms that have been arranged in several families to include, as follows: The spinning and the harvest mites (*Trombidiidæ*), the snouted mites (*Bdellidæ*), fresh-water mites (*Hydrachnidæ*), parasitic mites (*Gamasidæ*), the ticks (*Ixodidæ*), the beetle-mites (*Oribatidæ*), the cheese-mites (*Tyroglyphidæ*), itch-mites (*Sarcoptidæ*), gall and bud-mites (*Phytoptidæ*), and others. The particular family to which this potato-beetle parasite belongs is the *Gamasidæ*, nearly all the species of which, in their wide distribution, live parasitically on mammals, fishes, birds, and insects. The common "chicken-louse," *Dermanyssus avium*, shown in Fig. 48, which is also found on caged canary birds, is a well-known species of this family.

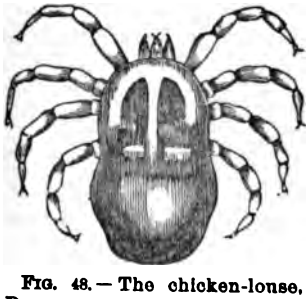

FIG. 48. — The chicken-louse, DERMANYSSUS AVIUM — enlarged.

From examples taken from some Colorado potato-beetles in Ohio, in 1873, this little Gamasid mite was described and named by Professor Riley as *Uropoda Americana*. It was found to be closely allied to a species that had long been known to infest beetles in Europe — the *Uropoda vegetans*, having the same habit of attaching itself to its host by a chord or filament, one end of which was fastened to the anal end of the mite and the other to the beetle. Many had been the surmises of the nature and object of this singular attachment in the European species. Some of the old writers had regarded it as a kind

of umbilical cord through which the mite drew its sustenance from its host, and others, that it was a silken thread spun by the mite to serve to fasten it and to prevent its being brushed off by the motions of the limbs of the beetle. Close examination showed, however, that it had no organic structure, that it was fragile and became easily detached; and finally, a French naturalist, M. Dugés, ascertained that it consisted simply of the viscous and dried excrement of the mite, which could be removed and replaced at every new excretion.

The discovery of this parasite in Massachusetts in such abundance is gratifying. There is scarcely a doubt that the dead beetles reported as covered by the "lice," were killed by the attack. (The same attack has in former years come under my observation, near Albany, where the beetles were so infested that every portion of their surface, including their legs, was so covered as to leave room for no additions unless they could be superimposed.) When received, although still upon the potato leaves, they were not feeding, but were evidently greatly debilitated and near their end. The occurrence of the parasite so early in the season (May) is also favorable, for every beetle now destroyed should serve to lessen the number of the pest that would have appeared later in the year by several hundreds. The present brood of beetles will be followed by at least one other during the year, and each female continues to deposit eggs, from time to time, during the five or six weeks of her natural life, until about a thousand have been deposited.

Our correspondent might render excellent service if he would inform himself whether this parasite is to be found in other localities in his vicinity, or in other portions of the State; and if not so found, if he will distribute the infested beetles and so extend the sphere of operations of the serviceable little mite. It would be necessary that they be sent attached to the beetle, as they die very soon after being separated from their host. If some of the potato leaves are put in the box with the beetles when packing them for transportation, there would be less liability of the mites being rubbed from them in transit.

The Cheese-mite Infesting Smoked Meats.

Tyroglyphus siro (Linn.).

From C. H. Wessels, provision broker, New York city, some pieces of smoked ham were received in June [1885], which were infested with myriads of a small white mite. Inquiry was made as to their nature and origin, and for some safe and effectual method of dealing with.

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them. No attack of the kind had previously come under the observation of Mr. Wessels, or of those engaged in the same trade with whom he had conferred.

Upon critical examination they were found to be identical with the common cheese-mite, *Tyroglyphus siro* (Linn.), a species which, although frequently occurring in vast numbers in cheese, has long been known to thrive equally well on several other articles of food. It is not at all uncommon in flour, and when observed therein by Linnæus, he presumed it to be a distinct species, and named it *Acarus farinæ*. When the same insect came under his notice in milk, it was designated by him as *Acarus lactis*. From unusual features presented in some examples, it was named and figured by De Geer (vol. 7, pl. 5, fig. 15) as *Acarus domesticus*, when he had found it occurring in meal, sugar, and smoked meats.

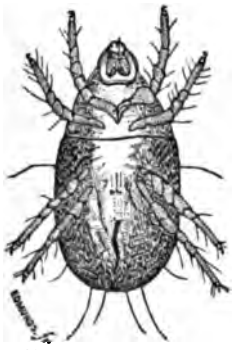

FIG. 49. — The cheese-mite, TYROGLYPHUS SIRO — enlarged.

This insect had not been previously known as infesting meats in this country,* although a closely allied species, *Tyroglyphus longior* Gervais, as identified by Professor Riley, had been found in a pork-packing house in a western city, in such abundance as to form layers of half an inch thick in places, beneath sacks of fertilizing material piled upon the floor, composed of livers, lungs, and kidneys, after they had been cooked and dried by steam (*American Naturalist*, xvi, 1882, p. 599). This latter species is distinguishable from the cheese-mite (according to Murray) by its more rapid movements, larger size, longer and more cylindrical body, and more shining hairs sticking out on every side. The habits of the two are said to be much the same, and it is of interest that in a small bit of the infested ham received by me that was sent to Prof. Riley, he identified an example of *T. longior* associated with *T. siro*. The two have been also found in association on old cheese, but *T. longior* in by far the smaller proportion — in but eight per cent upon some Rochefort cheese, and only one per cent on Septmoncal. It is this species which, about half a century ago, enjoyed for a time the notoriety of having been brought into being as a human creation through the electrical experiments of Mr. Cross, named at the time as *Acarus horridus*, before its identity with *T. longior* had been ascertained.

As the origin of the mites occurring upon the ham could not be readily answered, inquiry was made of Mr. Wessels as to the source of the meat, its method of curing, and for any other information that

* See subsequent notice of the same insect infesting smoked meats in Everett, Pa., in *Fortieth Rept. N. Y. St. Mus. N. H.* for 1886, p. 130.

might be pertinent to the question. The following communication was returned:

Replying to yours of the tenth of June, we would state that the hams in question are cured in the western part of Ohio, and in a brine made of salt, saltpetre, and sweetened either with sugar or syrup. They are packed fresh from the animal in tierces, the brine poured in and the package closed — the meat being then left to cure, a process requiring from forty to sixty days, although they remain in this condition from one to twelve months. They come east in that shape and are here taken out of pickle as they are wanted, and smoked. The dipping of which you inquire, is never done to packed hams, but only to bagged or canvassed hams; and is done that the coating may protect them from the deposit of eggs by flies. The smoking that we gave them was not to exterminate the pest, but to prepare them for market. It had, however, no effect upon the insect except to make it more easily discernible. The attack seems to be increasing rapidly, through germination or some other process.

From the above statement, it seems probable that the mites had their source in the establishment in which they were packed — an infested pork-packing house, as in the instance above cited. As a remedy, simple, inexpensive and probably effectual, recommendation was made to Mr. Wessels of dipping the meat in a weak mixture of carbolic acid and water. Used in the proportion of one part of the acid to 100 parts of water, it would, with scarcely a doubt, destroy the mite, not injure the meat for food, nor would the creosotic odor of the carbolic acid impart a disagreeable smell to it.

Before venturing to recommend the above wash for a meat which is sometimes partaken of in an uncooked state, the opinion of Dr. Willis G. Tucker, the distinguished chemist of the Albany Medical College, was asked, and the following answer received:

Yours, concerning use of carbolic acid for destroying flour-mites on ham, is at hand. The internal dose of the acid is about one grain (or one drop of the diliquesced crystals) for an adult. In large enough quantity or a sufficiently concentrated state, it is a caustic, escharotic, and violent poison. It must be used with care, and I would suggest the possibility of its affecting the salableness of the hams, for its odor, slightly different from creosote, might prove objectionable. It is soluble in twenty parts of water. A strength of one to 500 is said to instantly destroy vegetable mold, both plant and spores, and to operate with equal destructiveness upon microscopic animalculæ. Hobbescyler says that all inferior organisms perish in a solution of one to 100. It is used at about this strength to kill the itch-insect, body-lice, etc. I would suggest trying a solution of this strength (1 to 100) or say an ounce to a gallon (1 to 128). If this should be effectual, I do not see how it can hurt the meat, and it certainly would be perfectly safe. If this does not kill the mites, then I would try double the strength.

THE CHEESE-MITE INFESTING FLOUR.

The following communication was submitted to me from a correspondent at Robin's Nest, Ill.:

A few days since a neighbor sent us a pan of wheat flour with the request that we examine it. Setting the pan in a quiet place for twenty-four hours, the surface presented a strange appearance — only comparable to that of an ant-hill — as though each grain was being separately moved. Slightly disturbing this surface and examining through a common sun-glass of low power, it was found to be full of very minute life. Taking a few particles from the mass upon the point of a penknife, and placing within the focus of a botanical glass, at least a half dozen lively little insects were to be seen. They somewhat resembled plant-lice in form, were white, evidently soft-bodied, and were covered with hair, possessed of two antennæ and six legs of a reddish-brown color. An apparent nest, from which a dozen or more would crawl forth, was not larger than the point of a small pin. It is much to be regretted that there was not a proper microscope at hand so that a more extensive examination might be made. Now, what are they — name, family, genus, and history? Where do they come from, and what are they doing in thus desecrating the staff of life?

Reply was made, substantially, that the insect was doubtless an Acarus, or mite — one of the family of the *Acaridæ*, which comprises the mites properly so called. The species could not be determined from the above description, but the conjecture was ventured that the critical examination of specimens would show it to be, if not the *Tyroglyphus siro*, well known in Europe as frequently infesting old flour (since its identity with the *Acarus farinæ* of Linnæus has been established), then a closely allied species of that genus.

In appearance it would probably bear a close resemblance to *Tyroglyphus sacchari*, or the sugar-mite, which occasionally may be found swarming in raw sugars, looking like minute white specks scattered throughout it. (The *mature* insects should have eight legs instead of six, as above stated.) As an illustration of the abundance in which these food-infesting mites may occur, it may be of interest to state that in an examination of sugars, instituted several years ago in London, England, to see to what extent the *T. sacchari* infested this material, its presence, in a living condition, was detected in sixty-nine out of seventy-two samples examined. In one sample of an inferior quality, from the number actually contained in one grain's weight, the computation was made that one pound of the sugar contained a hundred thousand of the mites. In the flour above referred to, it is probable that they were even more abundant than in the sugar.

Perhaps no satisfactory explanation can be given of the presence in such numbers of the mite in the flour, nor is it known to what extent

it occurs in the flour of our markets. If the species has been introduced in any flouring mill, then we can readily see how a few specimens could find entrance into many, or most, of the barrels sent therefrom. Although the insect multiplies in almost incredible rapidity, yet, in consideration of the ordinary ready sale and quick consumption of our great staple, it would not ordinarily increase to a sufficient extent to attract attention. If permitted to remain for several months before it is used, until it becomes *old flour*, it might easily become in a condition to be properly characterized as *alive*.

Of course it would not be at all agreeable to know that our vegetable diet was so highly charged with animal matter. Yet, as the intrusion is not of foreign material, but of elements scarcely changed — little other than transformed — we need not be deterred from partaking with our usual zest of the fresh wheaten loaf that graces our board, by the thought that, perchance (without our knowledge), a hundred thousand lives had paid tribute to its production.

Food of Cermatia forceps Raf.

In the notice of this Myriapod contained in my *Fourth Report on the Insects of New York*, it is stated that it had shown itself so remarkably sensitive to confinement, that upon all the occasions that it had been brought to me alive, it had invariably died within two days thereafter. The question was asked — can it succumb so quickly for want of its proper food, or to need of moisture? The question has been answered in some experiments made by Miss L. A. Marshall, of the Industrial School of Albany, who, becoming interested in its habits, had kept an example under observation for a period of over three months in an ordinary drinking glass with a piece of thin muslin bound over its top. It was daily supplied by her with three or four drops of water, which were taken with apparent avidity. If the drops clung to the lower surface of the muslin, it would ascend the side of the glass to get them as they hung. It had also been given occasionally small flies and young croton-bugs, which it ate, and in one instance it was seen to eat a young individual of its own species.

That the Cermatia is dependent upon at least a daily draught of water would appear from the fate of a specimen which Miss Marshall had brought to me for my personal study after having been in her possession for some weeks. It had been placed in a muslin-covered glass and given as much water as it would accept. The following day being Sunday, it was not visited at my office. On the morning thereafter it was found lying dead in the jar.

More direct evidence of this insect being a fly-feeder has lately been communicated to me by Professor S. A. Forbes. He had learned from a very intelligent lady teacher of Golconda, Ill. (on the Ohio river), that the Cermatia had been very abundant a few years ago, at her house on an island in the river. It had been for some time a constant terror to the household who supposed it to be dangerous and poisonous, but later it became famous among them as a fly-killer, devoting itself entirely to the pursuit of house-flies, of which it was so greedy that it would sometimes hold one, or even two, while it caught a third, and devour each in turn.

JULUS CÆRULEOCINCTUS BENEATH CARPETS.

Mr. W. G. Warren, of Buffalo, N. Y., sends (in April) examples of this common myriapod which he had found in the corners and under the border of the carpet — a heavy Moquet — in his drawing-room. They were apparently confined to the extreme edge of the carpet, near the walls. They had not occurred in any abundance. Ten examples were sent for name. An enlarged figure of it is given above.

FIG. 50.—Thousand-legged worm, JULUS CÆRULEOCINCTUS—enlarged.

A lady residing at Loudonville, Albany county, N. Y., has also discovered the same *Julus* under similar circumstances. Specimens were sent, in October, with the inquiry if they had any connection with the carpet-beetle, for since she had been troubled with that pest, these had been found quite frequently and usually in association with the beetle. In May of the following year, after the house had been closed during the winter, additional examples were sent me in compliance with request, with the statement that they were all that were found on the opening of the house. The broken pieces indicated about ten specimens.

No reason is known for the intrusion of these creatures in the localities where they are above reported. If drawn thither for food, the nature of their food under such circumstances is an interesting inquiry.

Although not belonging to the insects proper, this myriapod is frequently submitted to the entomologist and information of it requested.

[See notice of "A Severe Attack on Potatoes" by this myriapod in the *Report of the Entomologist for the year* 1886, p. 131—40th St. Mus. Rept.]

(A.)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year (1888), giving title, place and time of publication, and a summary of contents. Lists of publications during 1884 and 1885, taken from the reports of the Entomologist to the Regents of the University S. N. Y., for the years 1884 and 1885 (of which only the State Museum and Documentary editions were published) are appended:

Egg-laying of Peach-Borer Moth.* (Country Gentleman, for February 9, 1888, liii, p. 109, c. 3 — 32 cm.)

In reply to an inquiry from New Jersey of the length of time that the moth is on the wing, it is stated that a satisfactory answer can not be made, even for that State — much less for different States of the Union. Observations of Drs. Harris, Fitch, Packard, Kellicott, Prof. Cook, and Mr. Saunders, are quoted, which seems to indicate that the period for oviposition in New Jersey may extend from the first week in June to the middle of September. During this time preventives should be used.

Some Pests of the Pomologist. From the American Pomological Society's Report for 1887. Read before the A. P. S. at its Boston meeting, September 15, 1887. (Separates, 4to, with cover and title page, 13 pp.) Published March 1, 1888.

The paper presents the following headings: Progress in Pomology; Evils attending Progress in Pomology; Need of Scientific Study; Demands of Science on the Pomologist; Immense Fruit Production — no Overproduction; Large areas devoted to Fruit Crops; Increase in Plant Diseases; Increase of Insect Ravages; Food-habits of Insects; Change of Food-plants; Introduction from Abroad; Spread of Scale Insects; Number of Insect Pests; An Unknown Currant Insect; How Insect Ravages are to be Met; Insecticides; Publications relating to Fruit Insects; Conclusion.

[Published, also, in the *Fourth Rept. Ins. N. Y.*, 1888, pp. 183–192.]

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The scale insect is *Chionaspis furfurus* (Fitch). The washes named should have destroyed it; in all probability they aided largely. Lye, soda, and potash washes are valued as very effective against the scale insects of California. Formulæ for two of the washes are given. "Heavy oil" from W. Virginia recommended for scales. Some of the lady-bugs are very efficient in destroying them, as *Chilocorus bivulnerus*, *C. cacti*, and species of *Scymnus*. Entomological knowledge would be needed for their collection in sufficient quantities for the purpose.

[Injurious Fruit Insects of the Vicinity of New York.] (Proceedings of the New York Farmers: 1886–87, pp. 52–59.) Published March, 1888.

Following some remarks on the aid that may be given to agriculture by economic entomology, its consequent importance, its commencement within recent times, its progress, and the high position it has attained; also, on the great increase of fruit insects and the causes therefor—the following insects are noticed and best remedies for them given: The apple-maggot (*Trypeta pomonella*); the apple-worm of the codling-moth; apple-tree aphis; bark-borers (*Xyleborus pyri*, and *Scolytus rugulosus* and *S. obesus*); plum-curculio; peach-tree borer; eight-spotted Alypia on grapevines; currant-worm; cabbage-butterfly (*Pieris rapæ*); and the Colorado potato-beetle.

Sulphur for the Elm Beetle. (Country Gentleman, for March 15, 1888, liii, p. 209, c. 2–3 — 30 cm.)

A notice in the New York Sun (copied) states that Mr. Dodd, of Orange, N. J., claims to have demonstrated that the attack of the elm-leaf beetle on elm trees can be thwarted by placing sulphur in one-inch augur holes bored in the sap wood five inches apart around the tree. Comment on this is made that the inefficacy of this method of protecting foliage, first announced sixty-six years ago, has often been shown. Sulphur could only be taken in the circulation when dissolved, and it is not soluble in sap. It has been found, unaltered, in plugged cavities of trees five years after insertion. It is doubtful if sulphur, if dissolved, would prove injurious to insects. Some experiments made by Dr. Fitch (given) indicate that it promotes their vigor and growth. [See page 240 of this Report.]

The Pea Weevil. (Country Gentleman, for March 22, 1888, liii, p. 229, c. 1–3 — 68 cm.)

The operations of the grub in the pea are described. It is a true weevil, belonging to the *Chrysomelidæ*. Description of the beetle is given, and its distribution in the United States and Europe stated. It has been very abundant in Canada. The eggs of the beetle are deposited on the pod, through which the larva burrows to reach the peas. Green peas containing the young larvæ may be safely eaten. Remedies and preventives are these: Keep the peas in a warm place, when the beetles will prematurely emerge in autumn, and die before they can oviposit the following season. They may be killed by dropping the peas in hot water for a minute, or by exposing them to camphor or kerosene, or by bisulphide

of carbon (manner stated). Plant no weevil-eaten peas. For severe weevil attack, stop cultivation throughout the infested district for a year. Late planting, from June first to tenth, is believed to be a preventive of attack.

The Elm-Leaf Beetle. (Country Gentleman, for March 29, 1888, p. 249, c. 2–3 — 20 cm.)

To inquiry from New Jersey of the best protection from the beetles, and how early the remedies should be used, reply is made that London purple, one pound to 200 gallons of water, with eight quarts of flour (prepared as directed), should be applied with a force-pump, fitted with a "cyclone nozzle," or one of the finest "Nixon nozzles," in a fine spray or mist. For high trees, the nozzle may be applied to the end of a long hose, tied, for elevation, to a bamboo rod." The tallest elms should be sprayed from the principal branches, by carrying into the tree a longer hose or a portable spraying apparatus. Spray as soon as the deposit of eggs is commenced — in New Jersey early in June. Repeat in a fortnight if necessary. [See pp. 239, 240 of this Report.]

Our Worst Enemies — The Bugs. (Country Gentleman, for April 5, 1888, liii, p. 269, c. 1–2 — 38 cm.)

In the subject as announced for remarks at the Chatham, N. Y., Farmers' Institute, bugs must be accepted, in popular American usage, as including all orders of insects. They may be regarded as the worst enemies of the agriculturist, for these reasons: They are so numerous, so prolific, so ravenous, such epicures, so wasteful, so small, so omnipresent, so secret, so regular in occurrence, and have such wonderful instincts for finding their food-plants and for self-protection.

They are to be fought by making their acquaintance through observation and the published literature, and learning of the best insecticides and how to apply them; what these insecticides are, and instruments used with them. Importance of the study of economic entomology urged, and coöperation in it solicited.

The Striped Flea Beetle. (Country Gentleman, for April 12, 1888, liii, p. 289, c. 1–3, figure — 64 cm.)

The insect, *Phyllotreta vittata* (Fabr.) is described and figured in both larva and imago. For killing the larva among the roots of its food-plants, solutions of pyrethrum, soap and carbolic acid, tobacco water, and kerosene emulsion may be used. For preventives of egg-deposit, strongly odorous substances, as kerosene mixed with sand, gas-tar on sticks or corn-cobs, tar water, drainage from pig-styes or the manure. Popular measures are dusting with lime, soot, ashes, snuff, tobacco dust, sulphur, and plaster. Dr. Fitch, of these, found ashes the best, as in experiments cited. He also recommended keeping young chickens and toads in gardens for hunting the beetles. Paris green or London purple sprayed over the young plants may be the best way to kill the beetle. Pyrethrum powder has been found effective.

Unrecognized Apple-Tree Attack. (Country Gentleman, for April 26, 1888, liii, p. 329, c. 2, — 17 cm.)

The injury to limbs of an apple tree, received from Mercer Co., N. J., can not be referred to any known insect. The first year's attack shows a small hole surrounded by blackened and dying bark, leading to an elongate empty egg-shell within the bark in a cyst-like cavity. No larval channel therefrom into the bark or wood is present. The second year after attack shows an unsightly scar of an inch or more in diameter, from which all the sap-wood is removed, with a new growth impinging on its border. The old bark is either removed from the dead wood beneath, or still held as a dried and depressed film over it. [Was subsequently referred to the oviposition of one of the flower-crickets.]

The White Flower-Cricket. (Country Gentleman, for April 26, 1888, liii, p. 329, c. 2–3 — 12 cm.)

Egg punctures in a Concord grapevine of a size as if made by a pin, arranged closely together in continuous, almost straight lines of two or three inches in length, are identified as those of *Œcanthus niveus* (Serv.). These punctures may kill the vines beyond them or cause them to die and break off. The insect does not feed upon any of the numerous plants in which it oviposits, but is carnivorous in its early life, eating plant-lice, etc.

The Leaf Hopper. (The Vineyardist, May 1, 1888, v. ii, p. 113, c. 1–3 — 81 cm.)

Remarks on the comparative injury caused by *Erythroneura vitis* on different varieties of grapes; its habits and nature of its injuries, description, and transformations; not a "Thrips," and what the *Thrips* is. The best remedy for it in graperies is vaporization of tobacco juice; how it is done in France. For destroying it in vineyards, spray the larvæ with tobacco water or soap-suds, or kerosene emulsion. Driving the winged insect on strips of tarred building-paper, stretched and carried between the rows of vines, has proved efficient.

To Kill Plant-lice. (Farm and Home, for May 1, 1888, ix, p. 158, c. 4.)

Plant-lice on apple trees are not difficult to kill, if attacked at the right time, with the proper apparatus and in the right manner. The proper time is early in the spring when they are hatching and before they are protected by the curling leaves, or when they are in the egg in the autumn, by spraying with a kerosene emulsion. The needed apparatus is a good force-pump and nozzle — the best of these are named. The right manner of applying the insecticide is to make it reach every insect; benefits of fine spraying stated.

[Revised, and printed in this Report, pp. 160–162.]

The Bacon-beetle attacks Comb. (The Bee Keepers' Magazine, May 1888, xvi, pp. 143, 144 — 62 cm.)

A beetle sent for name, the larvæ of which had attacked some empty honey-comb and riddled the wax, is *Dermestes lardarius* Linn. Its habits are given, together with those of some allied species, and the larva and

beetle described. This is the second recorded instance of its feeding on wax. In Europe wax is sometimes eaten by insects — possibly by this species.

Elm Leaf Beetle. (Country Gentleman, for May 10, 1888, liii, p. 366, c. 3–4 — 13 cm.)

Identification of *Galeruca xanthomelæna* from Scarsdale, N. Y., and in answer to inquiries, reference is made to notices in the *Country Gentleman*, giving full information of the insect, the principal of which are these: October 12, 1882, p. 805; October 15, 1885, p. 841; May 27, 1886, p. 409; May 26, July 21, and September 8, 1887, pp. 421, 565, and 695; March 20, 1888, p. 249 — the last giving full spraying directions.

Friends, not Foes. (Country Gentleman, for May 31, 1888, liii, p. 430, c. 3 — 13 cm.)

Small beetles sent from West Newton, Pa., as injurious in hot-beds to flower-plants, etc., by destroying the fibrous roots and thereby killing the plants, are of two species, neither of which can cause the injury of which complaint is made. *Tachus incurvus* Say, is one of the predaceous *Carabidæ*, and it is known to eat other insects. *Homolota lividipennis* Mann., is one of the *Staphylinidæ*, a family of useful insects which serve as scavengers of decaying vegetable and animal matter.

Maple-Leaf Mite-Gall. (Country Gentleman, for June 14, 1888, liii, p. 460, c. 4 — 14 cm.)

Leaves of soft maple sent from Suffolk county, N. Y., are one-third covered with wart-like elevations of about the size of the head of a common pin, which are caused by the leaf-mite, *Phytoptus quadripes* (Shimer). The formation and appearance of the gall is described, and burning the infested leaves or spraying with a tobacco solution the latter part of June is recommended.

A Grapevine Pest. (Orange County Farmer, for June 21, 1888, vii, p. 5, c. 1 — 15 cm.)

The galls of *Lasioptera vitis* O. S., identified on the leaves and tips of a Muscadine vine, from Port Jervis, N. Y. Description of the gall, the insect that produces it, the contained larva, its escape from the gall and subsequent transformations. Removal and burning of the infested leaves and tips the best preventive of future attack.

Cockscomb Elm-Gall. (Country Gentleman, for June 28, 1888, liii, p. [496, c. 1 — 10 cm.)

The galls sent on the "weeping slippery elm," from Charlottesville, Va., are described and identified as those of *Colopha ulmicola* (Fitch), and reference for a more extended notice of them, made to the C.-G. for September 23, 1886, p. 713. The gall, thus far, has only been recorded on the white elm, *Ulmus Americana*, and the leaves sent seem to be of that species.

[See, also, *Glyphina ulmicola*, in *Fortieth Rept. N. Y. St. Mus. N. H.*, 1887, pp. 126–128.]

Apple-Tree Tent-Caterpillar: Clisiocampa Americana. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 2, 3 — 28 cm.)

The best preventive of the injuries of this pest is the removal of the belts of eggs, which may be easily done when the trees are leafless. The next best is to destroy the nest with its occupants as soon as it can be recognized in the forks of the branches. The caterpillars may be poisoned by spraying the foliage with one pound of London purple in 200 gallons of water. The amount of harm done by this insect is in diminishing the yield of fruit and its quality in proportion to the amount of defoliation. The abundance of the insect the present year in this State has been phenomenal, nothing approaching it having been previously observed. For this no satisfactory cause can be assigned.

Honey-Dew on Hickory Leaves. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 3 — 16 cm.)

Hickory leaves, apparently of *Carya alba*, received from Clarksburg, W. Va., are thickly coated, on their upper side, with "honey-dew." Several species of Aphides are known to secrete this material, but in some instances it results from a diseased condition of the leaves, causing the excretion of a honeyed substance. In this case it is thought to have been excreted from the leaves, for reasons stated. Reference is made to *Lachnus caryæ* occurring on the pig-nut, *C. porcina*.

Grape-Leaf Galls. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 4 — 8 cm.)

Galls on a Rogers' seedling, from Worcester, Mass., are identified as those of *Lasioptera vitis*, the larva of which is briefly noticed. The best preventive known of this attack is to remove and burn the infested leaves and tips during early June, before the larvæ leave them for their further development in the ground.

A New Pest Threatens the Hay Crop. (Albany Evening Journal, for July 7, 1888, p. 7, c. 3.)

A correspondent from Delmar, Albany county, N. Y., writes of a minute insect infesting the base of the upper joint of Timothy grass, and arresting its development. From examples submitted, it proves to be a species of *Thrips* which may be identical with that which has long invested June grass (see Report of Entomologist for 1886, in 40th Rept. St. Museum Nat. Hist., pp. 96-98), but being at present in the larval stage, can not be determined.

Stalk-borer. (Country Gentleman, for July 12, 1888, liii, p. 532, c. 1-2 — 16 cm.)

A larva from Rock Hall, Md., where it is known as the "bud-worm," and is infesting young corn by burrowing downward into the stalk, is identified as *Gortyna nitela* Guenée. Distinguishing features of it are given, vegetation that it attacks, and the best remedies for it. Reference is made to other notices of the insect.

An Entomological Friend. (Orange County Farmer, for July 12, 1888, vii, No. 45, p. 8—12 cm.)

An insect sent for name from Port Jervis, N. Y., as destructive to the plum crop, by eating into the fruit, is identified as the harmless 15-spotted lady-bug, *Anatis 15-punctata* (Oliv.). [The parti-colored singular looking pupæ, fastened to the fruit, were probably mistaken for excremental matter thrown out by borers within.] The service rendered by the insect is stated, and the importance of its protection.

The Ash-Grey Blister-Beetle. (Country Gentleman, for July 19, 1888, liii, p. 547, c. 2–3—47 cm.)

Beetles very destructive to the foliage of potatoes at Charlottesville, Va., are *Macrobasis unicolor* (Kirby), one of the four common species of blister-beetles of the Northern and Middle United States. Their blistering properties are referred to and compared with that of the imported Spanish fly, *Cantharis vesicatoria*, a notice of which is given. *M. unicolor* is described and its habits and food-plants stated. Recent study of our blister-beetles is mentioned, and observations which have shown them to possess carnivorous habits. A remedy is found in Paris green; preventives in lime, plaster, or road dust.

Insects on Apple Trees. (Country Gentleman, for July 19, 1888, liii, p. 548, c. 1—8 cm.)

Insects sent from Norfolk, Va., and represented as causing the so-called "black knot" on apple trees, particularly on the "Early Harvest," can not have caused the injury complained of, as one is the apple-worm of the codling-moth, and the other an unknown Lepidopterous pupa. What is commonly known as the "black knot," does not occur on apple trees, and what this "knot" on the apple trees is, can not be told without examination of specimens.

The Light-Loving Grapevine-Beetle. Anomala Lucicola. (Country Gentleman, for July 26, 1888, liii, p. 565, c. 3–4—23 cm.)

Beetles from grapevines at Hightstown, N. J., are *Anomala lucicola* (Fabr.). Their general features are given and colorational characters which apparently indicate the sexes. Instances are narrated of their fondness for, and injuries to, the foliage of the grapevine. Preventives of attack are dusting the leaves with air-slacked lime. Spraying at night when collected on the vines, with pyrethrum water, should be serviceable.

The Black Long-sting. (New England Homestead, for August 4, 1888, xxii, p. 286, c. 5—30 cm.)

Thalessa atrata (Fabr.) is described and illustrated in a figure from Harris' Insects Injurious to Vegetation. It and *T. lunator* (Fabr.), in their larval stage, feed externally as parasites on the larva of *Tremex columba* within its burrows in maple, elm, etc. They are usually to be found associated with Tremex attack, and are very serviceable in its arrest.

A Grapevine Caterpillar — Thyreus Abbotii. (Country Gentleman, for August 19, 1888, liii, p. 599, c. 2–4 — 43 cm.)

A caterpillar taken from the "common ivy" is sent, with inquiry, as "a revolting specimen" of insect life. Its common food-plants are grapevine and Ampelopsis or the woodbine — the latter probably the "ivy" named. The principal features of the moth and of the dimorphic forms of the larva are described: The form marked by the large, yellow, subquadrate spots is far from "revolting." No cause can be assigned for these two quite distinct forms, which are not sexual, seasonal, or dependent on food. The white color and the caudal horn of the young larva are referred to, also the contortions, when disturbed, of the adult. Absurd ideas of the poisonous nature of these Sphinx larvæ are quoted.

The Spittle Insects. (New England Homestead, for September 15, 1888, xxii, p. 333, c. 1–2 — 34 cm.)

Insects on grass in a substance resembling spittle, at Auburn, Mass., are Hemiptera in their larval stage, of the group known as "spittle-insects." The "spittle" is produced, according to Uhler, by expulsion from the beak, while observations of DeGeer are quoted on its expulsion from the anus. Different species are named and their food-plants given. In Vermont they have seriously damaged the hay crop, but they seldom occur in injurious numbers.

[For notice of these insects, see pp. 243–246 of this Report.]

Fly on the Heads of Cattle. (Country Gentleman, for September 20, 1888, liii, p. 705, c. 4 — 10 cm.)

Inquiry is made from Hamilton Square, N. J., of a fly which is exciting much interest and anxiety from its reported habit of boring in the horns of cattle and depositing an egg, the grub from which burrows into the brain and causes the death of the animal. Nothing is known of such an insect. If such existed, it and its habits would have been known to entomologists. It would, therefore, not be worth while to coat the horns with tar, as is being done, for a preventive.

[For notice of this insect, see pp. 220–227 of this Report.]

The Melon Plant Louse. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 2–3 — 30 cm.)

Muskmelon leaves sent from Lowell, Mass., as showing destruction of the crop when about half-grown, are infested with a plant-louse which seems to be *Aphis cucumeris* Forbes. The aphis is described, and its history given, and a notice of a parasitic attack upon it in Illinois. Some shoots of the plants also sent have been transformed into galls which have disclosed a Cecidomyia. If undescribed, it may be named as *Cecidomyia cucumeris*.

The Hag-Moth Caterpillar. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 3–4 — 17 cm.)

A caterpillar found on an apple tree at Buckner's Station, Va., is sent as an example of mimicry in insects, from its resemblance to a dead and curled leaf. It is *Phobetron pithecium* (Sm.-Abb.), its common name

meaning a shriveled and monkey-faced old woman. Its singular appearance is described and its habits and food-plants given — the latter, apple, cherry, plum, and some of the forest trees.

[For an extended notice of this insect, see pp. 183–192 of this Report.]

An Ichneumonized Caterpillar. Interesting Case of Parasitism. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 4 — 20 cm.)

A caterpillar taken from a hop-vine and sent from Wabash, Ind., for name and other information, is one of the Sphinges, too much changed for positive identification, but probably, *Darapsa Myron* (Cram.), a common gravevine-caterpillar which, after reaching maturity, may have wandered to hops. The cocoons covering its body were probably those of *Apanteles congregatus* (Say); but instead of giving out their Microgaster ichneumon, through a nicely-fitting hinged lid, a minute Chalcid had emerged from each cocoon through an irregular hole eaten in the side, presenting an interesting case of secondary parasitism. The Chalcid has not been determined.

Thousand-Legged Worms. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 4 — 10 cm.)

Worms destroying geraniums by eating their roots, at Cape May, N. J., are *Julus cœruleocinctus* (Wood). These thousand-legged worms are difficult to kill when buried in the ground. Applications recommended are lime-water as strong as may be safely made, soot applied to the surface, and nitrate of soda to be followed by watering, or to be used in solution. Possibly quassia water might make the roots distasteful to them.

Bee-Keeper's Guide. (Country Gentleman, for September 27, 1888, liii, p. 727, c. 2 — 13 cm.)

Notices the *Manual of the Apiary* of Professor A. J. Cook, just published, in its thirteenth edition, which has been entirely rewritten, greatly enlarged, and much improved. Some of the new features introduced in this edition are noticed. It has been pronounced the best book on bees ever published.

Yellow-Necked Apple-Tree Caterpillar. (Country Gentleman, for October 4, 1888, liii, p. 743, c. 4 — 27 cm.)

Caterpillars sent from New York city, as devastating apple trees, are *Datana ministra* (Drury). The caterpillar is described, and its feeding habits, its injuries, its food-plants and its history given. Remedy — cutting off the branch on which the colony is clustered and crushing.

The Cow-Fly, Horn-Fly, or Texan-Fly. (Country Gentleman, for October 11, 1888, liii, p. 759, c. 2–3 — 36 cm.)

Examples of the cow-fly, noticed in the *Country Gentleman* of September twentieth, page 705, have been received from Kenneth Square, Pa. The species is unknown to me and is reported as unknown to the Entomological Department at Washington. It has been submitted to Baron Osten Sacken, of Germany. Its habits as gleaned from different sources are given. It seems to have been first noticed in Chester Co., Pa., in 1886.

Oak Galls. (Country Gentleman, for October 18, 1888, liii, p. 775, c. 2—7 cm.)

Small, round, pubescent galls, sometimes single, oftener confluent on oak leaves (*Quercus* sp. ?) from Kingston, R. I., are identified as those of *Neuroterus verrucarum* O. S.—one of the *Cynipidæ*. No means are known by which these galls can be prevented. Their multiplication can be arrested by picking off and burning the leaves containing them, when not involving too much labor.

The Cow-Fly or Texas Fly. (Country Gentleman, for October 18, 1888, liii, p. 779, c. 2—7 cm.)

The fly is stated by Dr. Williston to be a species of *Stomoxys*, apparently undescribed and which he purposes to name *S. cornicola* [erroneously given as *cervicola*]. Now that it is known to be allied to *Stomoxys calcitrans*—a biting species with which we have been long familiar, the many stories of the serious and sometimes fatal injuries to cattle of this new insect, are effectually disproved.

Caterpillar on the Chestnut. (Country Gentleman, for October 18, 1888, liii, p. 786, c. 2—12 cm.)

Caterpillars sent from Rochester, N. Y., from a Spanish chestnut tree, are *Halesidota tessellaris* (Sm.-Abb.). The general appearance of the moth is given. The caterpillar feeds on several of the forest trees and is common on the sycamore. It has not been recorded from the chestnut.

The White Grub of the May-beetle. (Bulletin of the New York State Museum of Natural History, No. 5, November, 1888, pp. 31, figs. 5.) Reprinted, with additions, from the Forty-third Annual Report of the New York State Agricultural Society for the year 1883.

The following are the subheads of the paper: The White Grub.—The Egg.—Injurious Character of the Insect.—Injuries from the Grubs.—Injuries by the Beetle.—Life-History.—Distribution.—Its Enemies.—Preventives and Remedies.—Study of the Insect Desired.

[Published, also, in *Trans. N. Y. St. Agricul. Soc.*, xxxiv, for 1883-1886, pp. 5-33.]

Cut-worms. (Bulletin of the New York State Museum of Natural History, No. 6, November, 1888, pp. 36, figs. 28.) Reprinted, with additions, from the Forty-fourth Annual Report of the New York State Agricultural Society, for the year 1884-1885.

The contents are as follows: What are Cut-worms?—Their Appearance.—Their Habits.—Habits of the Moths.—Natural History.—Conditions Favorable to Cut-worms.—Their Food-plants.—Abundance of Cut-worms.—Literature of the Cut-worms.—List of Species.—Natural Enemies.—Parasites.—Preventives and Remedies.—Two Preventives specially Commended.

[Published, also, in *Trans. N. Y. St. Agricul. Soc.*, xxxiv, for 1883-1886, pp. 66-100.]

Red-Humped Apple-Tree Caterpillar. (Country Gentleman, for November 22, 1888, liii, p. 875, c. 2–3 — 26 cm.)

Caterpillars feeding in company on an apple tree in New York, are *Œdemasia concinna* (Sm.-Abb.). They are described, and their habits and range of food-plants given. From their gregarious habit, they should not be permitted to inflict serious injury on fruit trees. Orchards should be inspected from time to time during August, and as soon as noticed the branch containing the company should be cut and each individual killed.

A Familiar Pest. (New England Homestead, for November 24, 1888, xxii, p. 421, c. 1–2 — 12 cm.)

A pupa sent for name and other information is that of *Sphinx quinquemaculata* Haworth, the larva of which is known as the potato-worm. The moth that it produces, feeding habits of the "humming-bird moths," features of their caterpillars, the tongue-case of the pupa, the "tobacco-worm," and "worming tobacco fields" are remarked upon.

Fourth Report on the Injurious and other Insects of the State of New York [November 23], 1888, pp. 237, Figs. 68. (From the 41st Report of the N. Y. State Museum of Natural History, 1888, pp. 123–358.)

The Contents are: INTRODUCTORY. INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS [as follows]: The Insects of the Hemlock: The Chalcid Parasites of Cecidomyia betulæ: Isosoma hordei (*Harris*) — the Joint-worm Fly: Thalessa lunator (*Fabr.*) — the Lunated Long-sting: Amphibolips prunus (*Walsh*) — the Oak-plum gall Cynips: Aulacomerus lutescens *n. sp.* — the Poplar Saw-fly: Currant Bushes Girdled by an Unknown Insect: Orgyia leucostigma (*Sm.-Abb.*) — the White-marked Tussock: Lagoa opercularis (*Sm.-Abb.*) — the Rabbit Moth: Nephelodes violans *Guenée* — the Bronze-colored cut-worm: Homoptera lunata (*Drury*), as a Rose Pest: A Hemlock Leaf-miner: Cecidomyia balsamicola *n. sp.*, and its Gall: Lasioptera vitis *O. S.*, and its Galls.: Chloropisca prolifica *O. S. n. sp.*, and its Winter Gatherings: Phytomyza lateralis *Fallen* — the Marguerite Fly: Megilla maculata *DeGeer* — the Spotted Lady-bird: Chauliognathus marginatus (*Fabr.*) — the Margined Soldier-Beetle: Sitodrepa panicea (*Linn.*), as a Leather-Beetle: Xylotrechus colonus (*Fabr.*), occurring in a Dwelling: Haltica bimarginata (*Say*) — the Alder Flea-Beetle: Crepidodera ruflpes (*Linn.*) — the Red-footed Flea-Beetle: Scolytus rugulosus (*Ratz.*) — the Wrinkled Scolytus: Corythuca ciliata (*Say*) — the Ciliated Tingis: Melanolestes picipes (*H. S.*) — the Black Corsair: Mytilaspis pomorum (*Bouché*) — the Apple-tree Bark-louse: Ptyelus lineatus (*Linn.*) — the Lined Spittle-hopper: Ephemera natata *Walker*, and other Ephemeridæ: Hair-snakes as Parasitic on Insects: Cermatia forceps (*Raf.*), as a Household Pest. BRIEF NOTES ON VARIOUS INSECTS: Dolerus sp.; Danais Archippus; Thecla strigosa; Nisoniades Persius; Sphinx Canadensis; Melittia cucurbitæ; Hyppa xylinoides; Erebus odora; Zerene catenaria; Anisopteryx pometaria; Tinea pellionella; Mallota sp.; Anthrenus scrophulariæ; Alaus oculatus; Thanasimus dubius; Macrodactylus

subspinosus; Lema trilineata; Chrysochus auratus; Trirhabda Canadensis; Galeruca xanthomelæna; Hylesinus opaculus; Phlœotribus liminaris; Belostoma Americanum; Ceresa bubalus; Chermes pinicorticis; Œcanthus niveus. APPENDIX. (A.) SOME EXTRA-LIMITAL INSECTS: Carpocapsa saltitans *Westw.*, and its Jumping Seeds: Systena blanda (*Mels.*)—the Broad-striped Flea-Beetle: Leptocoris trivittatus (*Say*)—the Box-elder Plant-bug: Mantis Carolina *Linn.*—the Carolina Mantis. (B.) ENTOMOLOGICAL ADDRESSES: The Present State of Entomological Science in the United States: Annual Address of the President of the Entomological Club of the American Association for the Advancement of Science: Some Pests of the Pomologist: (C.) LIST OF PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEAR 1887: (D.) CONTRIBUTIONS TO THE DEPARTMENT DURING THE YEAR 1887. (E.) ERRATA IN FORMER REPORTS. GENERAL INDEX. PLANT INDEX.

Identification of the Cow-Fly — Hæmatobia serrata. (Country Gentleman, for November 29, 1888, liii, p. 893, c. 2–3 — 20 cm.)

The fly, which has been the subject of former communications in the *Country Gentleman* and which Dr. Williston purposed soon to describe as *Stomoxys cornicola*, has been determined by Baron Osten Sacken, of Germany, to be identical with *Hæmatobia serrata* of R. Desv., of Southern France and Italy. Other generic references of the fly are given.

[See notice of this insect on pp. 220–227 of this Report.]

Wire-Worms. (Country Gentleman, for November 29, 1888, liii p. 893, figs. 1–6, c. 3–4 — 51 cm.)

To an inquiry from Potter county, Pa., for means of relief from excessive injuries from wire-worms, three of the best remedies are named and remarked upon at some length, viz., starvation, a crop of buckwheat, and a crop of mustard. As a guard against mistakes often made, the difference between wire-worms, cut-worms, and thousand-legged worms are pointed out and illustrated by figures.

Egg Deposits of Flower Cricket. (Country Gentleman, for December 6, 1888, liii, p. 911, c. 1 — 24 cm.)

Grapevine from Eaglesville, O., show egg-deposits in rows (described) which have hitherto been referred to the white-flower cricket, *Œcanthus niveus* Harris; but there are reasons for believing them to be those of *Œ. fasciatus* DeGeer—a valid species, and not a variety of *niveus*. The remedy for the attack is cutting off and burning. Food-habits of the insect stated.

The grape leaf eating beetle of which inquiry is made, is *Pelidnota punctata* (Linn.)—remarks upon it.

White-Marked Tussock Egg-Clusters. (Country Gentleman, for December 6, 1888, liii, p. 911, c. 1–2 — 16 cm.)

The eggs on cocoons sent for name from Salem, N. J., are those of *Orgyia leucostigma* (Sm.-Abb.). The insect is pernicious. Its egg-bearing cocoons (these only) should be destroyed, and where they may be looked for. One of the cocoons gave out a parasite, *Pimpla conquisitor* Say.

PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1884 AND 1885.

A New Sexual Character in the Pupæ of Some Lepidoptera. (Psyche, iv, No. 115–116, November-December, 1883, pp. 103–106 — Issued February 11, 1884.) An abstract in Proceedings of the American Association for the Advancement of Science, held at Montreal, Canada, August, 1882, xxxi, 1883, pt. ii, p. 470–471.

Remarks upon the interest attaching to the sexual characteristics of insects; mentions a number of such sexual features; they are fewer and less marked in the earlier stages. The particular feature noticed in this paper is one pertaining to the *Cossinæ* and to the *Ægeriadæ*, viz., in the male, the *tenth segment* (not counting the head as one) is furnished with two rows of teeth, while the female uniformly has but one (as have the two following segments in each sex).

[Published in the *Second Report on the Insects of N. Y.*, 1885, pp. 213–217.]

A Horn-Tail — Urocerus Cressoni. (Country Gentleman, for January 3, 1884, xlix, p. 9, c. 1 — 11 cm.)

In reply to an inquiry from Perth Amboy, N. J., the species is named, and its affinities given, and its habits in the larval and perfect stages. It occurs in the Middle States, and interesting varieties have been recorded from Albany, N. Y.

Fuller's Rose Beetle — Aramigus Fulleri. (Country Gentleman, for January 17, 1884, xlix, p. 49, c. 2 — 32cm.)

The species identified from Stamford, Conn. Its first notice as a pest in conservatories in 1874, and its subsequent distribution; its life-history, as given by Prof. Riley, in the *Rept. Commis. Agricul.* for 1878; remedies for it, and reference to publications upon it.

[See *Second Report on the Insects of N. Y.*, 1885, pp. 142–144.]

The Lunated Long-Sting—Thalessa lunator (Fabr.). (Country Gentleman, for April 17, 1884, xlix, p. 331, c. 3–4 — 52 cm.)

Captured in Augusta, Ga., while ovipositing April first; identified, a figure given, and method of oviposition stated; the insect upon the larva of which it is parasitic, *Tremex columba*, is also shown. A note from Prof. Riley is added, which gives the statement that the parasite feeds on the Tremex larva while attached to its exterior.

[Extended in the *Fourth Report on the Insects of N. Y.*, 1888, pp. 35–42.]

An Insect Attack on a Julus. (The Canadian Entomologist, for April, 1884, xvi, p. 80 — 7 cm.)

Communicating an observation of a swarm of minute insects surrounding, darting upon, and seriously annoying a Julus. Could they have been Ichneumon flies?

Insect Injury to Grapevines. (Country Gentleman, for May 8, 1884, xlix, p. 397, c. 1 — 25 cm.)

Some pieces of grapevines, bearing pinhole-like punctures, from Hopkinsville, Ky., are recognized as having been punctured for oviposition,

by *Œcanthus latipennis*—one of the flower crickets, closely allied to *Œ. niveus*. The punctures and method of oviposition are described, and reference made to figures in Fifth Missouri Report on Insects, page 119. The punctures are not injurious to the vine, but the crickets may possibly cut the stems of the grapes.

Squash Borers. (Country Gentleman, for May 8, 1884, xlix, p. 397, c. 2 — 6 cm.)

Injuries to squash vines, noticed in the Country Gentleman of April twenty-fourth, and there ascribed by the editor to the striped cucumber beetle, *Diabrotica vittata* (Fabr.), are recognized as caused by the squash-vine borer, *Melittia cucurbitæ* (Harris).

The Punctured Clover-Leaf Weevil. (Country Gentleman, for May 29, 1884, xlix, p. 457, c. 2–3 — 56 cm.)

Larvæ submitted from East Avon, Livingston county, N. Y., prove to be the mature forms of *Phytonomus punctatus* (Fabr.). Its present known distribution is given, the transformations, description of its cocoon, and reference to writings upon it. Prompt resort to effective remedies are urged, of which are thorough plowing, and rolling the clover after twilight, at which time the larvæ are feeding.

[The same in the *Ontario County Times*, extra, of May 29, 1884.]

A New Clover Pest — Its ravages in the southern portion of Canandaigua. (Ontario County Times, extra, May 29, 1884 — 30 cm.; Ontario County Times of June 4, 1884, p. 3, c. 4–5 — 85 cm.)

Examples of the larvæ sent by the editor are identified as *Phytonomus punctatus*. To resist the attack plowing is recommended, rolling not being as useful now after the insect has entered the ground for pupation. Reference is made to the notice of the insect in the *Country Gentleman* of May twenty-ninth, and its republication suggested to the editor.

A Corn Cut-worm. (Bulletin No. lxxxvi, of the New York Agricultural Experiment Station, Geneva, May 31, 1884 — 32 cm.)

In reply to an inquiry from Batavia, N. Y., of a cut-worm cutting off corn at the surface of the ground, the different habits of cut-worms are referred to, and recommendation is made of poisoning them by sprinkling London purple over the plants. Another method, which has proved quite effective, is to employ boys to dig them from the hills; mention of a crop saved by this means.

The White Grub of the May-beetle — Lachnosterna fusca. Read before the New York State Agricultural Society at the annual meeting January 16, 1884. (Forty-third Annual Report of the New York State Agricultural Society, for the year 1883, [June fifth], 1884, pp. 20–87, 5 figures.)

Gives an epitome of what is known of this serious pest, and indicates what is needed to complete its life-history. It is treated of under the following heads: The beetle; the white grub; the egg; injurious

character of the insect; injuries from the grub; injuries of the beetle; life-history; distribution; its enemies; preventives and remedies; study of the insect desired.

The Squash-Vine Borer — I. Melittia Cucurbitæ. (Country Gentleman, for June 5, 1884, xlix, p. 477, c. 2–4 — 50 cm.)

Gives, in reply to inquiries made from Coxsackie, N. Y., descriptions of the caterpillar and moth of the above-named insect, and remarks upon the family of *Ægeriadæ*, to which it belongs.

The Squash-Vine Borer —II. (Country Gentleman, for June 12, 1884, xlix, p. 497, c. 2–3 — 40 cm.)

The life-history, so far as known, and habits of the insect are given. Its injuries appear to be increasing with the increase of cultivation of the Hubbard squash. Its abundance at times is shown in the fact that 142 larvæ have been cut from a single vine.

The Squash-Vine Borer —III. (Country Gentleman, for June 19, 1884, xlix, p. 517, c. 1–3 — 74 cm.)

Treats of remedies and preventives, viz: Autumn plowing and harrowing, gas-lime, kerosene, strong-smelling substances as counter-odorants (especially bisulphide of carbon), covering the plants with netting, cutting out the larvæ, rooting the plants at the joints, guano, and London purple, and saltpetre. Additional observations are asked for upon points mentioned.

[The above notices embodied in the *Second Report on the Insects of N. Y.*, 1885, pp. 55–68.]

The Bacon Beetle — Dermestes Lardarius. (Country Gentleman, for June 26, 1884, xlix, p. 537, c. 2 — 25 cm.)

The beetle and larva are described, their food stated, allied species referred to, and inclosing bacon, etc., in whitewashed paper or cloth bags recommended as the best protective from attack. No method is known of preventing attack on salted meats if exposed to the insect.

The Maple-Tree Scale-Insect. (Country Gentleman, for July 3, 1884, xlix, p. 556–7, c 4–1 — 20 cm.)

Identifying *Lecanium innumerabilis* (Rathvon), from Phœnix, N. Y., June 6, describing the scales as at present with the eggs beneath them, and later, when the eggs are extruded, enveloped in waxy fibres. The active larval stage the best time for killing the insects, with whale-oil soap solution or kerosene and milk emulsion. [Is *Pulvinaria innumerabilis*.]

The Spring Canker-Worm — Anisopteryx vernata (Peck). (Country Gentleman, for July 10, 1884, xlix, p. 577, c. 2–3 — 30 cm.)

In answer to inquiries and examples sent from two localities in Westchester county, N. Y.— identification of the species; remarks upon the importance of arresting its spread in the State, and recommendation of destroying he pupæ in the ground beneath the trees; arresting the

ascent of the female moth by tarring the trunks or by tin bands; jarring the larvæ from the limbs into a straw fire beneath, and spraying the tree with Paris green or London purple in water.

The Buffalo Gnat. (Country Gentleman, for July 10, 1884, xlix, p. 577, c. 3–4 — 52 cm.)

The gnat, of which inquiry is made from Memphis, Tenn., is an undescribed species of *Simulidæ*, few of which family have been studied — even the "black fly" of the Adirondack region bears only a manuscript name. The habits and transformations of the *Simulidæ*, in general, are given, with reference to particular species observed. Various notices of the buffalo-gnat are quoted.

[It has subsequently been named by Professor Riley as *Simulium pecuarum*. See his extended notice of it in *Rept. Comm. Agricul.* for 1888, pp. 492–517, p ates vi–ix.]

The Carpet-bug. (Amsterdam, N. Y., Daily Democrat of July 21, 1884, p. 3, c. 3–4 — 68 cm.)

In a letter to the editor in reply to inquiries, are given — What the insect is; habits of the insect; not possible to exterminate it; means of protection; means of destruction; hunting the "bug" urged.

The Elm-tree Beetle. (New York Weekly Tribune, for July 23, 1884, p. 10, c. 4 — 13 cm.)

Referring to a recent statement in the *Tribune* that the elm trees in Flushing, L. I., were being destroyed by this insect, recommendation is made of the method given by Mr. Glover in the Agricultural Report for 1870, of placing frames around the base of the trees, so constructed as to prevent the egress of the larvæ that descend the trunks for pupation and their entrance into the ground by a layer of cement. The northward progress of the insect in New York is stated.

[See pp. 234–242 of this Report.]

The Carpet Beetle — Anthrenus Scrophulariæ Linn. (Country Gentleman, for August 14, 1884, xlix, p. 676–7, c. 4–1 — 48 cm.)

Gives in reply to inquiries from Manchester, Vt., its habits, habitat, injuries, materials eaten, and transformations. Among the best preventives and remedies are mentioned carbolic acid, creosote, gas-tar paper, benzine and kerosene, cyanide of potassium, fumigations of closets with sulphur, and frequent searches for the larvæ.

Insects Mining Beet Leaves. (Country Gentleman, for August 14, 1884, p. 677, c. 2 — 13 cm.)

Leaves sent from Erie, Pa., are infested with larvæ of a species of the *Anthomyiidæ*, probably one of the three species mentioned in the *First Report on the Insects of New York*, 1882, pp. 203–211. Some of the characteristics of these flies are given, with notice of their mining operations in this country.

Peach Root Aphis. (Gardener's Monthly and Horticulturist, Phila., September, 1884, xxvi, pp. 271–2—29 cm.)

A root aphis which is destroying all the seedling peach trees of Mr. Lorin Blodget, at Philadelphia, is believed to be *Myzus persicæ* Sulzer. For destroying it the following are suggested: Hot water, leached ashes and sulphur, bisulphide of carbon and soluble phenyle. As superior to the above, the sulpho-carbonates are recommended, and M. Dumas, of the French Academy, quoted upon their use.

A New Rose Pest — Homoptera Lunata. (Country Gentleman, for September 1, 1884, xlix, p. 737, c. 1–2—25 cm.)

Caterpillars feeding at night on rose buds in a rose-house in Madison, N. J., proved to be *Homoptera lunata.* This food-plant had not been previously recorded. The life-history of the species, as detailed by Prof. French, is given, together with Guenée's description of the caterpillar; also mention of the sexual difference in the moths, and the distribution of the species. Injury from the larvæ in rose-houses best prevented by hand-picking them.

[A revision of the above in the *Fourth Report on the Insects of N. Y.*, 1888, pp. 57–59.]

Jumping Seeds. (Country Gentleman, for September 11, 1884, xlix, p. 757, c. 1–2—40 cm.)

The seed-vessels described; said to be a species of *Euphorbia.* The contained insect (a lepidopter) causing the motion, was described and named as *Carpocapsa saltitans*, by Prof. Westwood, in 1858—later by M. Lucas as *C. Deshaisiana.* The interesting generic relation of the insect is referred to, its leaps described, their cause explained, and period of emergence of the moth stated. Three other kinds of jumping seeds are known. Reference to further information.

[Extended, in *Fourth Report on the Insects of N. Y.*, 1888, pp. 151–154.]

The White Grub — Lachnosterna fusca. (Country Gentleman, for September 11, 1884, xlix, p. 757, c. 2–3—22 cm.)

In reply to inquiries from West Stockbridge, Mass., of remedies, etc., reference is made to a paper upon the insect giving about all that is known of it published in the *Forty-third Annual Report of the New York State Agricultural Society*, for 1883. The starvation remedy, as there given and believed to be effectual, is quoted.

An Insect Attack New to the State — Isosoma tritici, on wheat, in Geneva. Bulletin 100, New York Agricultural Experiment Station, Geneva, N. Y., October 4, 1884—86 cm.)

First noticed in Illinois in 1880; its difference from *Isosoma hordei;* location in the upper internodes of the straw; the larvæ more abundant in the straw examined than elsewhere seen; the wheat greatly shriveled; life-history of the insect; its description; two parasites infest it; remedies found in burning the stubble and straw; preventive in rotation of crops.

[Is *Isosoma hordei* (Harris); see *Fourth Report on the Insects of N. Y.*, 1888, pp. 27–35.]

A Stinging Bug — Melanolestes Picipes (H. S.). (Country Gentleman, for October 23, 1884, xlix, p. 877, c. 2–3 — 40 cm.)

An insect reported as inflicting a painful sting upon a lady in Natchez, Miss., is *Melanolestes picipes*, or the "Black Corsair." It is distributed over the United States, and has been previously noticed for the serious wounds it inflicts. Other Hemiptera of the *Reduviidæ* having similar stinging habits, are the *Conorhinus sanguisuga* LeConte, *Melanolestes abdominalis* (H.-S.), *Reduvius personatus* (Linn.), and *Prionotus cristatus* (Linn.). The above are briefly noticed in their habits and painful wounds.

[Extended, in the *Fourth Report on the Insects of New York*, 1888, pp. 109–114.]

An Attack on the Apple Worm — A Friend, Not a Foe. (Country Gentleman, for October 30, 1884, xlix, p. 897, c. 2–4 — 52 cm.)

A larva sent from Crozet, Va., as injurious to apples, from eating large holes into their sides and causing rot, proves to be *Chauliognathus marginatus* (Fabr.). It is not injurious, but enters apples through holes already made, to feed upon the apple-worm — the larva of *Carpocapsa pomonella*. The larva and beetle are described, the latter by comparison with *Ch. Pennsylvanicus*. The holes in quinces, thought to have been made by the same larva, are probably those of the quince curculio, *Conotrachelus cratægi*, in leaving the fruit.

[Extended, in the *Fourth Report on the Insects of New York*, 1888, pp. 84–88.]

Clover Insects. (Transactions of the N. Y. State Agricultural Society, xxxiii, 1877–1882, [October], 1884, pp. 206–207.)

In the republication of the paper on "The Insects of the Clover Plant," from the annual report of the society for the year 1880, a list of the names with reference to authorities of twenty-four species is given, as an addition to the forty-six previously recorded, making the number now known seventy. Mention is made of the list of apple insects (additions in MS.) being extended to one hundred and eighty.

The White Grub. (The New England Homestead, for November 8, 1884, xviii, p. 393, c. 1–3 — 80 cm.)

Treats of the insect under the following heads: The grub; the beetle; its distribution; its food-plants; injuries by the beetle; life-history; its enemies; preventives and remedies. Under the latter head salt is recommended as an experiment, while starvation is pronounced infallible.

Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1883. (Thirty-seventh Annual Report on the New York State Museum of Natural History, by the Regents of the University of the State of New York, [November], 1884, pp. 45–60.)

Reports upon the collections made during the year and other work of the entomologist. Among insects of special interest collected are some

Trypetidæ, *Grapta Faunus*, *G. j-album*, *Feniseca Tarquinius*, and *Agrilus torpidus*; remarks upon *Agrotis clandestina* and *Simulium molestum*; notice of the operations of *Orgyia leucostigma* in girdling elm twigs, and causing them to drop; the English sparrow promoting insect injury; an extended notice of the appearance of the chinch-bug, *Blissus leucopterus*, in northern New York, with recommendations made, and distributed in a circular, for the arrest of its ravages.

The Apple-leaf Bucculatrix. (The Husbandman, Elmira, N. Y., for December 3, 1884, xi, No. 537, p. 1, c. 5 — 31 cm.)

Apple twigs received from Malcolm, Seneca county, N. Y., are covered with the cocoons of *Bucculatrix pomifoliella*. The cocoon is described and life-history of the species given. The remedies mentioned are spraying, or scouring with a stiff brush the infested branches with a kerosene and soap emulsion, of which the formula is given, for killing the insect within the cocoon; Paris green in water for poisoning the caterpillars, and jarring the caterpillars from the trees and burning them in the months of July and September.

[Extended, in the present Report, pp. 260–262.]

On some Rio Grande Lepidoptera. (Papilio, iv, Nos. 7–8, September–October, 1884, pp. 135–147.) [Published February, 1885.]

Gives an annotated list of collections made by Messrs. Sennett and Webster, in 1877 and 1878, viz.: In Rhopalocera, fifty-two species (*Kricogonia Lanice* and *Apatura Cocles*, being new species); in Sphingidæ, four species (*Sphinx insolita* n. sp.); in Ægeriadæ, two species; in Bombycidæ, three species (*Ecpantheria Sennettii* n. sp.).

Scale-Insect Attack on Ivy. (Country Gentleman, for February 26, 1885, l, p. 169, c. 2 — 22 cm.)

Ivy leaves (*Hedera helix*) received from Watervliet, N. Y., and infested on both surfaces and the stem also by *Aspidiotus nerii* Bouché — a scale-insect which infests the cherry, plum, currant, maple, oleander, etc., throughout most of the United States. Remedies recommended under different conditions are scraping, a soap solution, and a soap and kerosene emulsion made in accordance with the formula given.

[Printed, also, in this Report, see pp. 278, 279.]

The Owl Beetle — Alaus Oculatus. (Country Gentleman, for April 9, 1885, l, p. 307, c. 4 — 14 cm.)

The beetle received alive in May, from Aiken, S. C., is described and its habits given. Proves upon later examination to be *Alaus myops* (Fabr.).

Remedies for the White Grub. (The New England Homestead, for May 16, 1885, xix, p. 205, c. 2 — 28 cm.)

The remedies usually recommended for the beetle, insufficient; the grubs may be destroyed by starvation; crops of buckwheat and mustard repel the grubs; how and when salt may be used with benefit.

Cut-worms. Read before the New York State Agricultural Society, at the Annual Meeting, January 21, 1885. (Forty-fourth Annual Report of the New York State Agricultural Society, for the year 1884, [May], 1885, pp. 56–80, figs. 1–20.) (Separate, with cover and half-title [June, 1885], pp. 25, figs. 20.)

The subject is treated of under the following heads: What are Cut-worms? — Their Appearance — Their Habits — Habits of the Moths — Natural History — Conditions Favorable to Cut-worms — Their Food-plants — Abundance of Cut-worms — Literature of the Cut-worms — List of Species — Natural Enemies — Parasites — Preventives and Remedies — Two Preventives Specially Commended — Conclusion.

A Potato-bug Parasite. (The New England Homestead, for June 6, 1885, xix, p. 237, c. 2 — 34 cm.)

A mite infesting and killing Colorado potato-beetles received from Middlesex county, Mass., is identified as *Uropoda Americana* Riley. Description is given of it, its peculiar connecting filament remarked upon, habits of the family of *Gamasidæ* to which it belongs, noticed, together with the importance of the attack, and recommendation of distribution of the serviceable parasite.

[Printed, also, in this Report, see pp. 289-291.]

The Visitation of Locusts. (The Argus [Albany], June 7, 1885, p. 4, c. 5 — 33 cm.)

The announced co-appearance of the seventeen-year locusts and the thirteen-year locusts will not occur in New York; why "locust" is a misnomer; not 221 years, as stated, since the two forms of Cicadas co-appeared, but only thirty years, also thirty-nine years ago; no ground for alarm, as the Cicada harms fruit trees only, and those usually not seriously; notice of the brood of seventeen-year Cicadas to appear about the present time in New York, at Brooklyn and Rochester.

The Pear-Blight Beetle. (Country Gentleman, for June 18, 1885, l, p. 517, c. 2, 3 — 46 cm.)

Xyleborus pyri (Peck), infesting the trunks of young apple trees and killing them, at Annapolis, Md., is identified; description of the beetle; origin of its common name; its two forms of attack; the burrows in the limbs and in the trunk described; the latter ascribed to a second brood but are probably made by the mature insect for food and shelter; remedy for the limb attack, cutting off and burning with the insect; for the trunk attack, not yet known.

The Canker Worm. (Country Gentleman, for June 18, 1885, l, p. 519, c. 2, 3 — 20 cm.)

Spread of the Canker-worm, *Anisopteryx vernata* (Peck) in the State of New York; notice of its presence in large numbers at Loudonville, Albany county; the attack is controllable at the outset, and should not be allowed to extend. The preventives and remedies are, bands, etc., to

prevent the ascent of the wingless female, spraying with Paris green water to kill the larvæ, and working the ground beneath the trees to crush the pupæ.

[Printed in present Report, pp. 258, 259.]

Insect Eggs on Strawberries. (Country Gentleman, for June 25, 1885, l, p. 537, c. 3 — 21 cm.)

The eggs do not indicate an attack that need impair our enjoyment of the fruit. Their presence is unusual and probably accidental. They are the eggs of some hemipterous insect, belonging probably to one of the larger plant-bugs. Description is given of them. The nauseous taste imparted to raspberries by the presence of a small bug, known as *Corimelæna pulicaria*, is referred to, and the insect described. This same insect attacks the blossoms and the stems of strawberries.

Plant-lice, Elm-beetles, etc. (New England Homestead, for July 4, 1885, xix, p. 269, c. 1–2 — 15 cm.)

Identification of *Schizoneura Americana* as injuring leaves of elms at West Stockbridge. The insect reported as stripping the leaves of the elms, is probably the elm-leaf beetle, *Galeruca xanthomelæna*, although not known before to extend so far into Massachusetts. May-flies perhaps mistaken for mosquitoes.

The Apple Tree Bark-louse. (New England Homestead, for July 4, 1885, xix, p. 269, c. 4–5 — 20 cm.)

Scales on bark of an apple tree sent are those of *Mytilaspis pomorum* of Bouché (*M. pomicorticis* Riley). Directions for destroying the insect, by scraping the scales and by spraying kerosene emulsion.

The Cut-Worm and Onion Maggot. (Country Gentleman, for July 9, 1885, l, p. 574–5, c. 4, 1 — 20 cm).

For the arrest of cut-worm ravages reported from Globe Village, Mass., the inquirer is referred to remedies given in the paper published in the 44th Rept. N. Y. St. Agricul. Society. For controlling *Anthomyia brassicæ* and *Phorbia ceparum*, the remedies are removing the plants with the soil containing the larvæ, and killing the pupæ with gas-lime or plowing and harrowing repeatedly. Preventives are, strong-smelling substances, and not planting in infested ground.

Peach and Cherry Borers. (Country Gentleman, for July 9, 1885, l, p. 575, c. 1 — 18 cm.)

Peach trees in Annapolis infested by *Phlœotribus liminaris*. It attacks the elm also. The cherry trees are probably infested by *Scolytus rugulosus* Ratz., recently introduced from Europe; see an interesting article upon this species in the Canadian Entomologist for September, 1884. The injuries of *P. liminaris* seem to be rapidly increasing in localities in the State of New York.

The Fig-Eater — Allorhina Nitida. (Country Gentleman, for July 9, 1885, l, p. 575, c. 2–3 — 15 cm.)

The species identified from Madison, N. J., and briefly described; its fondness for juicy fruits; is not known to occur in New York; the larva

is one of the white grubs, and is quite injurious to the roots of grass; its abundance in Washington; the beetle is a pollen feeder and sometimes occurs in great numbers, as in an instance cited. The "trim flower-chafer" might be a better common name for it.

The Roundheaded Apple-tree Borer — Saperda Candida Fabr. (Country Gentleman, for July 16, 1885, 1, pp. 590–1, c. 4, 1 — 33 cm.)

Borers in hawthorn [in Westchester Co., N. Y.], are probably the *Saperda candida;* its burrows and method of destroying the grubs with a strip of flexible steel; recommendation by Dr. Fitch of cutting out the grub; discovering the location and crushing the egg; killing the eggs by application of lye; benefit of mounding about the tree; washing with soap, and soap placed in the forks of the trees for preventives; principal publications upon the insect.

Entomological. [Answers to inquiries.] (Country Gentleman, for July 16, 1885, 1, p. 592, c. 2-3 — 20 cm.)

Paris green recommended for killing the potato-beetle infesting egg-plants; road-dust may prevent their attack. For the injuries of the rose-bug, at Waddington, N. Y., to apples and cherries, beating them from the trees recommended; to the former, Paris green might be applied. The abundance of this insect upon fruit trees at times, cited.

The Cause of Black-Knot. (Country Gentleman, for July 23, 1885, 1, p. 607 c. 1–2 — 26 cm.)

It is not, as is popularly believed, of insect origin, but is produced by a fungus originally named *Sphæria morbosa*, but recently transferred to the genus *Plowrightia*. There are not "three distinct species," but the same one attacks *Prunus domestica, P. Americana, P. cerasus, P. Virginiana, P. Pennsylvanica* and *P. serotina* — two plum trees and four cherry trees. Six species of insects have been bred from the black-knot. The remedy is to cut off and destroy attacked twigs and branches early in July.

[Revised, and printed in this Report, see pp. 280, 281.]

The Cucumber Moth. (Country Gentleman, for July 23, 1885, 1, p. 607, c. 2, 3 — 28 cm.)

The borer attacking a melon patch in Carp, Tenn., is, from the description sent, probably the larva of *Phakellura nitidalis* (Cramer), popularly known as the "pickle-worm." In New York and the Eastern States the squash-vine borer *Melittia cucurbitæ* takes its place. The appearance and the habits of the pickle-worm are described. The moth is also described. For remedies, destroy the bored melons, sprinkle with London purple or Paris green water while the moth is ovipositing. Figures of the insects are referred to. The borer [illegible] possibly be *P. hyalinatalis*, of which the habits are di[illegible]

Apple Insects and the Rhinoceros-beetle. (Country Gentleman, for July 30, 1885, l, p. 623, c. 2–3 — 25 cm.)

Of apple insects sent from Coffee, Va., one is *Orgyia leucostigma*, and the other had spun up in a cocoon [subsequently emerged and proved to be *Acronycta* sp.]. The information sent of the *Dynastes Tityus*, that the beetle comes from the ground among the ash trees where its larva had probably been feeding on living vegetable matter, is a new and interesting fact. The record of the manner in which the beetles eat the bark of the ash is also interesting, as also the mention of their being very destructive to tobacco plants; killing all that they attack. [See page 230 of this Report.]

Another Potato Pest. (New England Homestead, for August 8, 1885, xix, No. 32, p. 309, c. 3.)

Macrobasis unicolor (Kirby), one of the blister-beetles, identified as the insect injurious to the foliage of potatoes, in Furnace, Mass. Beating the insects into a basin of water and kerosene, or if very abundant, sprinkling with Paris green or London purple in water, is recommended.

Rœstelia aurantiaca. (Country Gentleman, for August 13, 1885, l, p. 661, c. 3–4 — 10 cm.)

Determination of the above fungus occurring on quinces received from Charlton, Mass. It has usually been found associated with insect attack, as in this instance, where the fruit has been burrowed by probably the apple-worm of the codling-moth.

The False Chinch Bug. (Country Gentleman, for August 13, 1885, l, p. 661, c. 4 — 26 cm.)

Insect described (but no examples sent) and reported as injurious to radishes, turnips, horseradish, strawberries, and raspberries, in Boulder, Col., are, without much doubt, the *Nysius angustatus* of Uhler. It had not previously been known to injure ripe strawberries, but had, according to observations of Professor Forbes, been quite injurious to the foliage of strawberries in Illinois. Kerosene emulsion or pyrethrum could be used to destroy the bug when upon strawberries, until the fruit is about half grown.

The Bag-Worm — Thyridopteryx Ephemeræformis. (Country Gentleman, for October 1, 1885, l, p. 801, c. 4 — 20 cm.)

To an interesting account of the habits of a "worm" destroying arbor vitæ hedges in Franklin Park, N. J., and request for information in regard to it, reply is made of its name as above, and the best methods for checking its injuries, viz., application of Paris green, and hand-picking, and destroying the cases of the female moth. A figure illustrating the several stages of the insect is also given.

The Red Spider — Tetranychus Telarius (Linn.). (Country Gentleman, for October 8, 1885, l, p. 821, c. 3–4 — 38 cm.)

Mites infesting various garden plants, at Utica, N. Y., are this species which, standing at the head of the Acarina, approaches near to the

spiders. It spins webs on the under side of the leaves for shelter, while sucking the juices of the various plants upon which it occurs; those upon which it was noticed at Utica are mentioned. It has this summer been discovered in an injurious attack on a quince orchard near Geneva, N. Y. Kerosene emulsion, soap solution with sulphur mixed, and quassia infusion may be used for killing it. It was the cause of the yellow discoloring of the leaves of a nasturtium in the garden of the writer.

[Printed, also, in this Report, see pp. 287–289.]

The Thirteen-year Cicada. (The Argus [Albany], for October 11, 1885, p. 4 — 32 cm.)

A paper read before the Albany Institute, containing remarks upon the exceptional long life-period of the *Cicada septendecim;* the number of broods occurring in the United States and in the State of New York; notice of a thirteen-year brood, and that its occurrence only in the Southern States may be the result of hastened development through higher temperature; Professor Riley's experiments in transferring the two forms from one region to another; and record of the planting of the eggs of a thirteen-year brood at Kenwood, near Albany.

[Printed, also, in this Report, see pp. 276–278.]

The Elm Leaf Beetle. (Country Gentleman, for October 15, 1885, l, p. 841, c. 3–4 — 23 cm.)

The inquirer, from Bordentown, N. J., of methods for killing the insects destroying the foliage of his elm trees, is referred to a notice of the insect, *Galeruca xanthomelæna*, in the *Country Gentleman* for October 12, 1882 (p. 805), and to Bulletin No. 6 of the Division of Entomology of the U. S. Agricultural Department. Of the arsenical insecticides recommended, London purple is preferred, in the proportion of one-half pound to three quarts of flour and a barrel (forty gallons) of water. Directions for mixing are given, and the advantages of its use stated.

The Clubbed Tortoise-beetle. (Country Gentleman, for October 15, 1885, l, p. 841, c. 4 — 12 cm.)

Remarks upon *Coptocycla clavata* (Fabr.), its appearance, habits and food-plants. Reference to its occurrence on the potato, tomato, and egg-plant.

A Leaf-mining Insect. (Home Farm [Augusta, Me.], for October 15, 1885, p. 1, c. 6 — 20 cm.)

A leaf-miner reported in Maine, and in the vicinity of Boston, Mass. is identified as one of the Anthomyians, and probably *Chortophila betarum* Lintn., which is known to have distribution in New York and Connecticut. The approved methods for meeting its attack, are prevention of egg-deposit by the use of counterodorants, and burning the infested leaves.

The Death-Watch, Clothilla Pulsatoria. (Country Gentleman, for October 22, 1885, l, p. 861, c. 3–4 — 21 cm.)

A supposed parasite found in cow-stalls in Warren, O., is this insect, a figure of which is given. The habits of the *Psocidæ* are briefly stated, and the reason why this species has received the name of the "death-watch." It has previously occurred in immense numbers in barn refuse after threshings, and in straw-packings in a wine cellar.

[See *Second Report on the Insects of N. Y.*, pp. 201, 202.]

Eggs of a Katydid. (Country Gentleman, for October 29, 1885, l, p. 881, c. 4 — 23 cm.)

Eggs sent from Lexington, Va., arranged in two rows upon the opposite sides of the back fold of a copy of the *Country Gentleman*, are those of *Microcentrus retinervis*, an insect common in some of the warmer States of the Union, and classed by some writers with the katydids, although strictly, the name of katydid would belong only to *Platyphyllum concavum*. The eggs are described, and reference made for the illustration and life-history of the species to the 6th Missouri Report.

[The name should have been given as *Microcentrum retinervum*.]

A New Insect Foe to the Cut-worm. (New England Homestead, for October 31, 1885, xix, No. 44, p. 405, c. 3–4 — 19 cm.)

A correspondent from Winsted, Ct., sends for information a fly hatched from some cabbage cut-worms kept in confinement. The fly is a species of *Gonia* belonging to the *Tachinidæ*, the parasitic habits of which are given. Caterpillars bearing upon their body the white eggs or the egg-shell of these flies should not be destroyed, but permitted to furnish food for the beneficial larvæ that are feeding within them. The cabbage cut-worm was probably *Mamestra trifolii* (Rott.).

Saw Fly on Fruit Trees. (Country Gentleman, for November 12, 1885, l, p. 921, c. 3–4 — 25 cm.)

In answer to an inquiry from Edinburgh, Scotland, of some small, thin, nearly transparent objects nearly half an inch long and looking like a leech, which for several years had nearly destroyed the leaves of plum, pear, and cherry trees, reply is made that it is the larva of some species of saw-fly, and probably of *Eriocampa adumbrata*. Its ravages may be prevented by means of powdered hellebore, to be obtained pure, and applied to the foliage by the hand or by a bellows. Its efficacy is illustrated by an account of its use in the Hammond Nurseries at Geneva, N. Y. Directions are given for using the hellebore mixed with water, if more convenient in this form.

(B.)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the contributions that have been made to the Department during the year (1888):

IN HYMENOPTERA.

Cocoons of *Nematus Erichsonii* Hartig, and the imago, May 8th. From Rev. H. W. SWINNERTON, Cherry Valley, N. Y.

Galls of *Neuroterus verrucarum* (O. S.), on *Quercus* sp.? From J. CARTER BROWN, Kingston, R. I.

Apanteles congregatus (Say) cocoons on ?*Darapsa Myron*. From Mrs. K. M. BUSICK, Wabash, Ind

IN LEPIDOPTERA.

Larvæ of *Thyreus Abbotii* Swainson, July 26th. From A. J. RICHMOND, Canajoharie, N. Y. The same, from Dr. R. H. SABIN, Troy, N. Y. The same (spotted form), from HORACE B. DERBY, Albany, N. Y., July 6th. The same (striated form), from S. C. BRADT, Albany, N. Y., July 8th.

Datana ministra (Drury) larvæ from apple tree, Sept. 4th. From M. T. RICHARDSON, New York city.

Œdemasia concinna (Sm.-Abb.) larvæ from apple tree early in September. From JOHN C. SHAW, Brooklyn, N. Y.

Callosamia Promethea (Drury) cocoons on wild cherry. From E. J. REDDY, Bayville, N. Y. The same, on plum, from Mrs. E. W. K. LASELL, Orange, N. J. The same, from BERTHOLD FERNOW, Albany, N. Y.

The regal walnut-moth, *Citheronia regalis* (Fabr.), taken at the State Camp, Peekskill, N. Y., August 5th. From Dr. C. W. CRISPELL, Kingston, N. Y.

Larva of *Eacles imperialis* (Drury) with puparia of a Tachinid-fly, Sept. 10th. From S. C. BRADT, Albany, N. Y.

Clisiocampa Americana Harris, larvæ and cocoon. From BERTHOLD FERNOW, Albany, N. Y.

Larvæ of *Gortyna nitela* Guenée, burrowing in stalks of young corn, June 22. From Rock Hall, Md.

Larvæ of *Cacœcia argyrospila* (Walk.) eating into young pears, June 13th; and of *Coleophora* sp.? eating into the same, June 8th. From P. BARRY, Rochester, N. Y.

IN DIPTERA.

"Flax-seeds" (puparia) of the Hessian-fly, *Cecidomyia destructor* Say, in wheat. From Prof. F. M. WEBSTER, LaFayette, Ind.

Galls of *Lasioptera vitis* O. S., June 27th. From H. L. FISK, Worcester, Mass.

Tipulid larvæ found in association with cocoons of *Nematus Erichsonii*, May 18th. From Rev. H. W. SWINNERTON, Cherry Valley, N. Y.

The "cow-fly," *Hæmatobia serrata* Desvd. From SAMUEL W. SHIMER, Mount Holley, N. J.

IN COLEOPTERA.

Dytiscus fasciventris Say. From JOSEPH HARVEY, Albany, Oct. 20th. The same from JOHN D. COLLINS, Utica, N. Y., Nov. 5th.

Dytiscus Harrisii Kirby, October 24th. From H. G. SETTLE, Saratoga Springs, N. Y.

The carpet-beetle, *Anthrenus scrophulariæ* Linn., from Crocus, April 27th. From Mrs. HOAGLAND, Albany, N. Y.

Alaus oculatus (Linn.). From Mrs. E. W. K. LASELL, Orange, N. J.

Anomala lucicola (Fabr.), the light-loving grapevine-beetle, July 13th. From W. W. SWEET, Hightstown, N. J.

Pelidnota punctata (Linn.), *Desmocerus palliatus* (Forst.), and *Saperda candida* Fabr. From C. G. BELKNAP, Branchport, N. Y.

Oak twigs cut by the oak-tree pruner, *Elaphidion parallelum* Newm. From GEORGE T. LYMAN, Bellport, N. Y.; also, from Dr. JAMES W. HALL, Sea Cliff, L. I., N. Y.; also, from C. FRED JOHNSON, Bayport, N. Y.

Monohammus confusor (Kirby). From BERTHOLD FERNOW, Albany, N. Y.

A Cerambycid-beetle (four inches in length, species undetermined), from Colon, Central America. From M. B. HARRIOT, Albany, N. Y.

The elm-leaf beetle, *Galeruca xanthomelæna* (Schr.), May 1st. From D. J. GARTH, Scarsdale, N. Y.

Aramigus Fulleri Horn, from a rose-house, June 30th. From W. J. PALMER, Rochester, N. Y.

Plum curculio oviposition in young pears, June 8th. From P BARRY, Rochester, N. Y.; also, the same, in young cherries, June 7th, from GEORGE S. POWELL, Ghent, N. Y.

The grain-weevil, *Calandra granaria* (Linn.), in wheat. From ABNER L. BACKUS & SONS, Toledo, O.

Young Duchess pear trees (sections) girdled by *Xyleborus pyri* (Peck), and containing the beetle, May 22d. From NORMAN POMROY, Lockport, N. Y.; also from E. S. GOFF, Geneva, N. Y.

Phlœotribus liminaris (Harris) — the living beetle in bark of peach tree, October 19th. From DAVID HUNTINGTON, Somerset, Niagara Co., N. Y.

IN HEMIPTERA.

Lygus pratensis (Linn.) *C. lineolaris* of Beauv., with young pears punctured and gnarled by it. From P. BARRY, Rochester, N. Y.

The melon plant-louse, *Aphis cucumeris* Forbes. From T. C. BARKER, Lowell, Mass.

The cockscomb elm-gall, *Glyphina ulmicola* (Fitch) on "weeping slippery elm," *Ulmus* sp.? From C. H. HEDGES, Charlottesville, Va.

The grapevine bark-louse, *Pulvinaria innumerabilis* (Rathvon), on soft maple. From H. E. HAYES, New York.

The cottony-cushion scale, *Icerya Purchasi* Maskell, on *Acacia* in Lamonda Park, Los Angeles Co., Cal. From A. O. OSBORNE, Waterville, N. Y.

The scurfy bark-louse, *Chionaspis furfurus* (Fitch), on a pear tree twig. From J. M. CLARKE, Albany, N. Y.

IN ORTHOPTERA.

Eggs of *Microcentrum retinervum* (Burm.) on currant stem and on *Cercis Japonica*. From Prof. W. S. ROBINSON, Elizabeth, N. J.; also from S. B. HUSTED (April 20th), Blauvelt, N. Y.

Eggs of *Œcanthus niveus* Serv. in Concord grapevines. From W. D. BARNES, Middlehope, N. Y. The same, from St. Catherines, Ontario; from E. S. GOFF, Agricultural Experiment Station, Geneva, N. Y.

Œcanthus niveus (De Geer) ♂. From JONAS BROOKS, Albany, N. Y.; also in both sexes, from Mrs. E. B. SMITH, Coeymans, N. Y.

Apple-tree twigs showing oviposition of an *Œcanthus*, not *niveus*. From W. L. DEVEREAUX, Clyde, N. Y.

Gryllotalpa longipennis Scud. From Dr. C. W. CRISPELL, Kingston, N. Y.

IN NEUROPTERA.

Corydalis cornutus (Linn.), the hellgrammite fly, August 5th. From Dr. C. W. CRISPELL, Kingston, N. Y.

IN ARACHNIDA.

Galls of *Phytoptus quadripes* (Shimer) on leaves of soft maple, June 5th. From E. DAYTON JOSLIN, Lake Grove, Suffolk Co., N. Y.

IN MYRIAPODA.

Julus cæruleocinctus Wood, from beneath a carpet. From WM. G. WARREN, Buffalo, N. Y., and from Mrs. IRA HARRIS, Loudonville, N. Y. The same, from roots of geraniums, September 27th. From JOHN B. HOFFMAN, Cape May, N. J.

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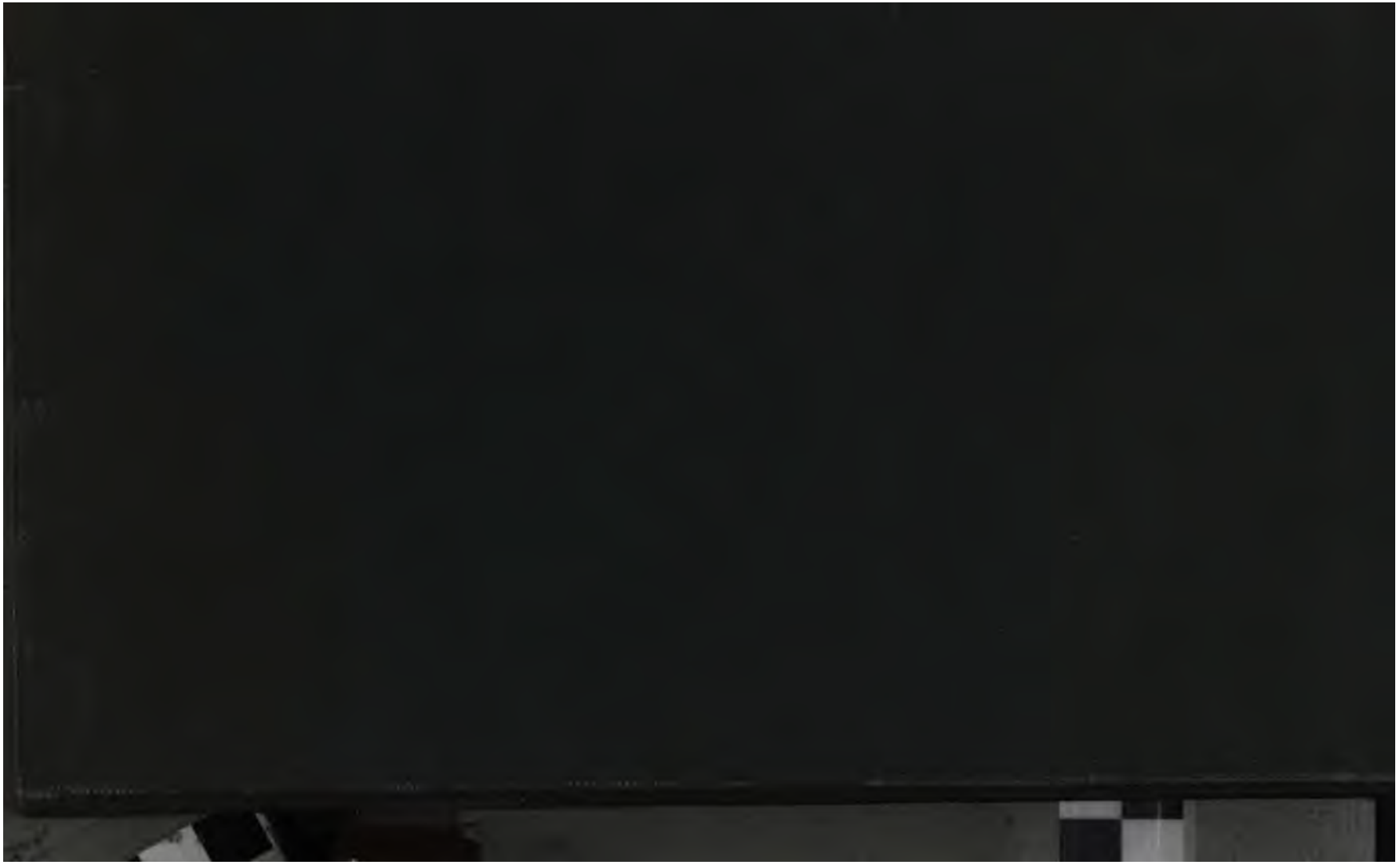
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